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A Descriptive Analysis Of Montana's Forest Resources

USDA Forest Service Resource Bulletin INT-11, 1975
INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION
Ogden, Utah 84401

HIGHLIGHTS

Montana has 23 million acres of forest--one-fourth the total area of the State. Currently there is a widespread interest in the use and management of these lands. They play a significant role in the State's economy and their use greatly influences the environmental quality of much of the State.

There are several principal forest zones, based primarily on elevation. At the lower elevation is the ponderosa pine zone, where forage production for wildlife and livestock and easily accessible recreation are an important part of the forest land use. The Douglas-fir, cedar-hemlock, and spruce-fir zones occur at intermediate elevations. Larch, white pine, and lodgepole pine are other major species in these zones where commercial timber values are greatest. The subalpine spruce-fir, and alpine zones are at the higher elevations. Water yields are greatest here, and these high elevations provide summer grazing and highly scenic recreation opportunities.

About three-quarters of the forested land is federally owned and most of the rest is in private ownership. During the last 20 years, the total area of forest land has remained almost constant, but the acreage of the principal timber-producing standard commercial forest lands has decreased in favor of deferred, special, and marginal commercial forest lands and Wildernesses and Primitive Areas.

While all of the forest provides recreational opportunities, recreation is the principal use of at least 3 million acres. In addition to legally established areas, such as National Parks and Wildernesses, this area includes about 800 developed sites and more than 1,700 private recreation residences on leased public lands. Privately owned campgrounds have recently become rather common and a few large forest-oriented resort complexes are now being developed. Montanans are avid fishermen and hunters. In 1970, 22 percent of all State residents purchased big game licenses.

Recreational use of the forest has not been without problems. Congestion in popular areas has occasionally led to severe environmental problems and sometimes has made solitude a rare commodity, even in Wildernesses. There have been frequent conflicts among different kinds of recreationists--particularly over the use of recreation vehicles and the proliferation of subdivisions--and between recreationists and those harvesting timber.

Both grazing and the development of mineral resources also are occurring on forested lands. One estimate is that more than half of these lands could support cattle or sheep. Perhaps 400,000 acres are directly involved in active mineral claims. In addition, coal mining is rapidly expanding and there are several hundred oil and gas leases, principally in eastern Montana.

The timber harvest currently is about 1.2 billion board feet annually and is the most important economic use of the forest. About 11 percent of all personal income in Montana, and half of the personal income in western Montana, are directly or indirectly dependent upon wood products. A six percent change in the State's timber harvest might lead to an increase or decrease of about 900 jobs.

Nearly all major facilities of the wood products industry are owned by multi-State corporations with headquarters outside Montana. Three of the largest of these corporations--St. Regis, Burlington Northern, and U.S. Plywood--are also the major private owners of forest land. The major wood processing centers lie to the west of the Continental Divide with the largest concentrations at Troy, Libby, Kalispell, Columbia Falls, Missoula, and Bonner. In addition to lumber mills, these include five plywood and two particleboard plants and one papermill. Substantial increases in capacity for processing all of these products are underway or have been proposed.

There are a number of environmental problems associated both with the harvesting and with the processing of wood products. Timber harvesting and associated road construction have been modified over the years to protect and enhance the other forest resources. This has been most obvious in a heavier reliance on partial cutting and smaller size clearcutting units. There still exist some as yet unresolved problems in the protection of both air and water quality, but considerable progress has been made in the last few years.

Montana's timber is primarily an old-growth resource. Douglas-fir is currently the single most important commercial species but lodgepole pine is the most abundant. Other commercially important species include ponderosa pine, Engelmann spruce, western larch, and the true firs.

The extent to which Montana's forest lands will provide timber in the future hinges both on the extent of the land base that will be devoted to timber production and the quantities of wood harvested from that base. If all the New Study Areas currently under consideration for addition to the Wilderness system are permanently reserved from timber harvest, perhaps 45 million board feet of timber harvest annually will be foregone. The direct impact of reserving the other areas that are presently unroaded would be on the order of hundreds of millions of board feet of foregone timber harvest. The New Study Areas are not included in present allowable harvest plans; other roadless areas are. The flow of wood products from lands not reserved from harvesting depends upon a combination of the level of investments applied to the land, the development of harvesting techniques that can overcome economic, esthetic, and ecological constraints, and the ability to fully utilize the fiber resource that is produced.

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USDA Forest Service
Resource Bulletin INT-11
January 1975

A DESCRIPTIVE ANALYSIS OF MONTANA'S FOREST RESOURCES

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PREFACE

Montana's total area is 93 million acres. Three-fourths of these acres are the wide open "Big Sky" spaces that have given rise to Montana's colorful history and image of cowboys, open range, brawling mining camps, and frontier hardships.

The other one-fourth of Montana is forest land--23 million acres in total. Although timber resources have been tapped for over 100 years--the first sawmill was established in 1842, and both Indians and early explorers relied on the forest for game and shelter--only in recent decades has the overall importance of the forest resources to the State been recognized.

This new perspective derives from the role that forest products harvest and manufacture now play in the economy of the State, and also a national interest in the preservation, environmental concerns, and conflict over forest land use.

In 1958, the Northern Region of the Forest Service, at the request of the Montana congressional delegation, prepared a report "Full Use and Development of Timber Resources in Montana" (USDA Forest Service 1958). This report discussed the timber resource and its potential utilization and industrial development. The report was printed as Senate Document No. 9, January 27, 1959.

This present analysis updates the 1959 report and expands its scope and content to include data on employment, income, and economics. In addition, many amenity values have taken on critical importance in forest land use and management, and these are presented in an analytical framework to the extent possible with available data.

The Intermountain Forest and Range Experiment Station was assigned the principal task of assembling data and preparing the report. The Northern Region provided detailed resource and harvest data and critical review throughout the writing of the report. Montana State University at Bozeman developed parts of the economic and employment analysis, primarily through its 1967 input-output model of the State's economy.

Many other agencies and individuals have also provided data and helpful comments for this report. These include the Bureau of Indian Affairs, Billings; the Bureau of Land Management, Billings; the Montana Department of Natural Resources, Division of Forestry, Missoula; and the Planning and Economic Development division of the Montana Department of Intergovernmental Relations at Helena.

Much of the forest land in Montana is public land, and therefore much of the data and discussion relates to forest resource activities of various agencies. However, the focal point of the analysis is the forest resource, inclusive of all ownerships. It is not our intent to deal with all public lands, or with public land management agencies, as such, but rather with the forest resource. For example, in discussing minerals our primary concern is mining that affects forest resources, and we have not attempted to include a discussion of the total mineral resource.

As is often the case in developing such a wide-ranging report, more data would have been desirable. But two conclusions stand out that would be altered only slightly, if at all, by more refined information.

Montana no longer has a large surplus of timber awaiting a market. There is sharp competition for currently available wood supplies. The economic values of the timber resource are important to Montana and are critical to many individual communities, especially in western Montana. But the vitality of the industry is directly dependent upon national economic conditions and national markets that are beyond the State's control.

Concerns for the manner in which all the resources of the forest are used have been effectively expressed by a variety of interests. Differences in opinion over forest land use are forcing the clearer definition of alternatives for reaching both commodity and noncommodity objectives. Hopefully, this report will help define those alternatives.

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MAP--MONTANA LAND OWNERSHIP Inside Back Cover

CHAPTER I

THE FOREST RESOURCE[1]

In all but the most recent of the many reports and summaries on Montana's forest lands that have been compiled over the years, the production of commercial timber products has been the dominant concern (Hutchison 1957; Herrington 1959; USDA Forest Service 1958; Bolle and others 1966; Wilson and Spencer 1967; Hutchison and Kemp 1952; Nelson 1963). Now, however, forest lands are viewed as producing many products, uses, and values--some of them intangible and difficult to measure. This section describes and quantifies the forest resources and the uses and activities related to them.

The Forest Land Base

Montana's forests change greatly in character in short distances because of the mountainous terrain. Five major climax forest zones have been identified based on the predominant tree species. Beginning at the lowest elevation, the zones are the ponderosa pine zone, the Douglas-fir zone, the grand fir and cedar-hemlock zone, the spruce-fir zone, and the subalpine zone. The relative elevations of these zones shown in figure 1 is typical for west-central Montana. In northwest Montana zone elevations would be somewhat lower and in southern and eastern Montana somewhat higher.

How these climax zones relate to various resource values is shown in figure 2. For example, among the five zones, highest timber values occur in the cedar-hemlock zone. (This is not to imply that timber values are higher than other resource values in the cedar-hemlock zone.)

The ponderosa pine climax zone (fig. 3) begins at the edge of low-elevation grasslands as scattered trees or sparse, parklike stands. This zone is too dry for any other commercially important conifers. Undergrowth may be grasses on the drier sites or shrubs under more moist conditions. This zone, which is extensive to the east but quite limited in extent to the west of the Continental Divide, has only low water and timber yields; it is intensively used for recreation and as a producer of forage for cattle and wildlife.

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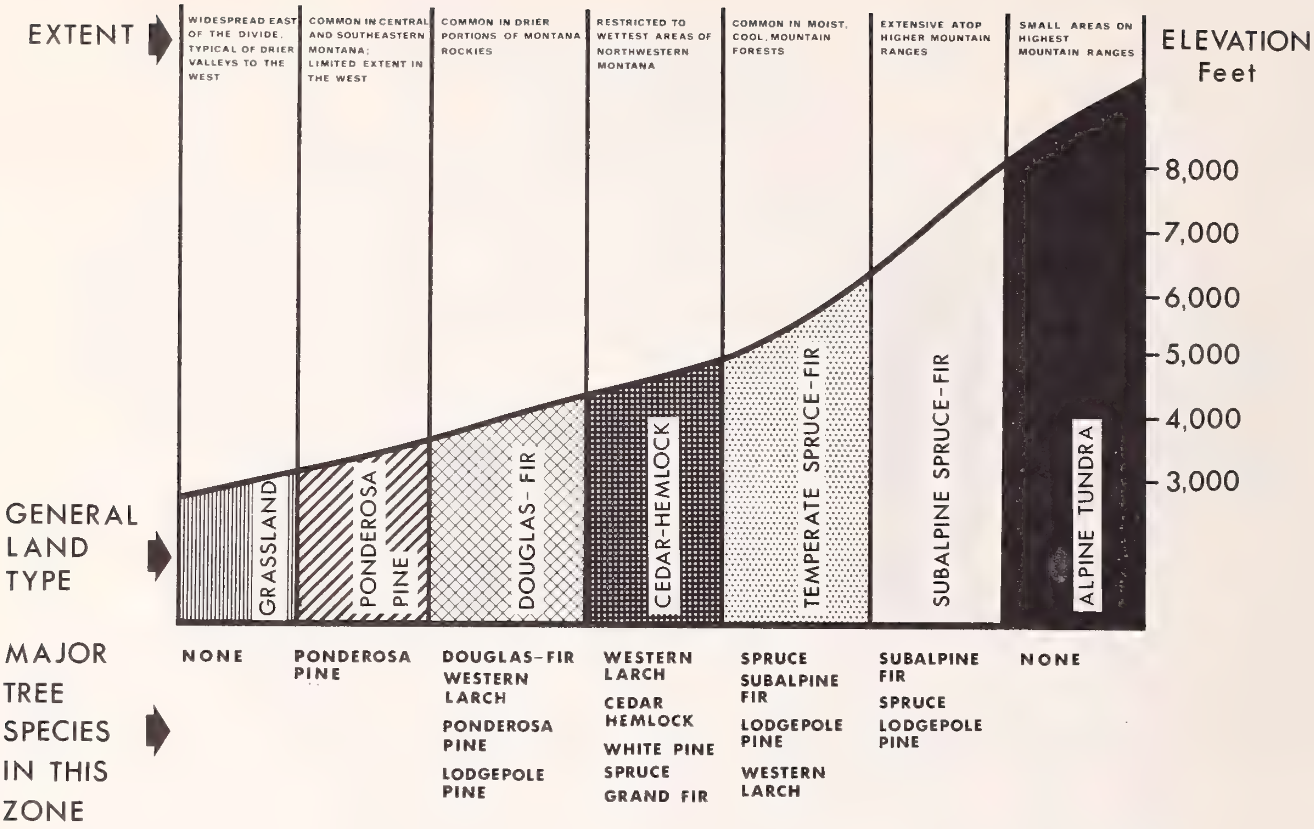
[1] Statistical data in this section have been derived from a number of sources. The most comprehensive single source is "The Outlook for Timber in the United States" (USDA Forest Service 1973a). These data are used for most of the report. However, data from reports of individual agencies may differ due to differences in definitions, statistical errors, and actual forest land changes over time. No attempt is made here to reconcile such differences, but sources of the data are specified.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WIDESPREAD EAST OF THE DIVIDE, TYPICAL OF DRIER VALLEYS TO THE WEST
COMMON IN CENTRAL AND SOUTHEASTERN MONTANA; LIMITED EXTENT IN THE WEST
COMMON IN DRIER PORTIONS OF MONTANA ROCKIES
RESTRICTED TO WETTEST AREAS OF NORTHWESTERN MONTANA
COMMON IN MOIST, COOL, MOUNTAIN FORESTS
EXTENSIVE ATOP HIGHER MOUNTAIN RANGES
SMALL AREAS ON HIGHEST MOUNTAIN RANGES
ELEVATION Feet
8,000
7,000
6,000
5,000
4,000
3,000
GENERAL LAND TYPE
GRASSLAND
PONDEROSA PINE
DOUGLAS-FIR
CEDAR-HEMLOCK
TEMPERATE SPRUCE-FIR
SUBALPINE SPRUCE-FIR
ALPINE TUNDRA
MAJOR TREE SPECIES IN THIS ZONE
NONE
PONDEROSA PINE
DOUGLAS-FIR
WESTERN LARCH
PONDEROSA PINE
LODGEPOLE PINE
WESTERN LARCH
CEDAR
HEMLOCK
WHITE PINE
SPRUCE
GRAND FIR
SPRUCE
SUBALPINE FIR
LODGEPOLE PINE
WESTERN LARCH
SUBALPINE FIR
SPRUCE
LODGEPOLE PINE
NONE

Figure 1.--Forest zones of Montana

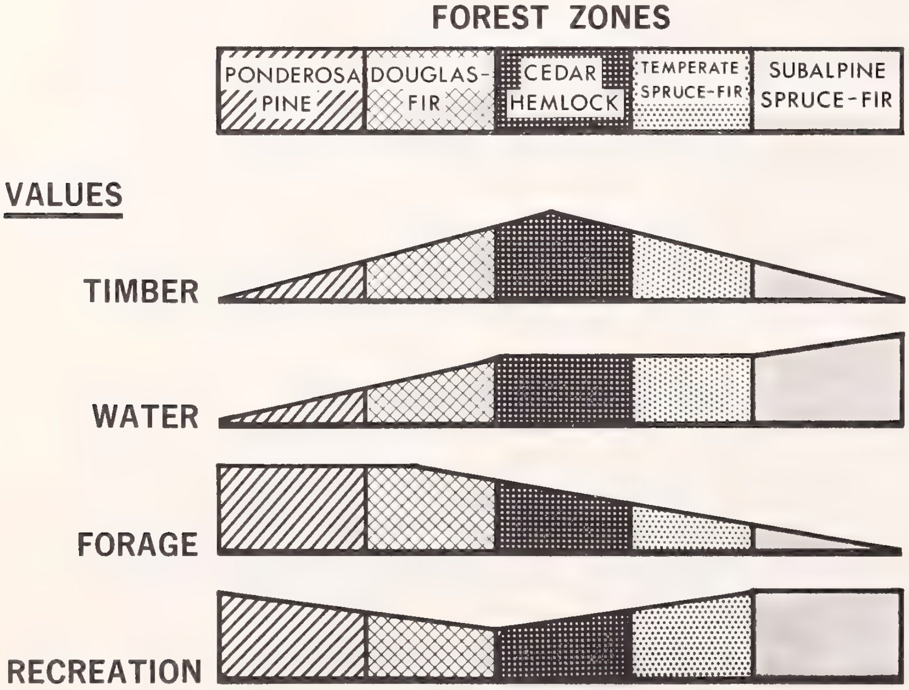


Figure 2.--Distribution of timber, water, forage, and recreation values by forest zones of Montana.

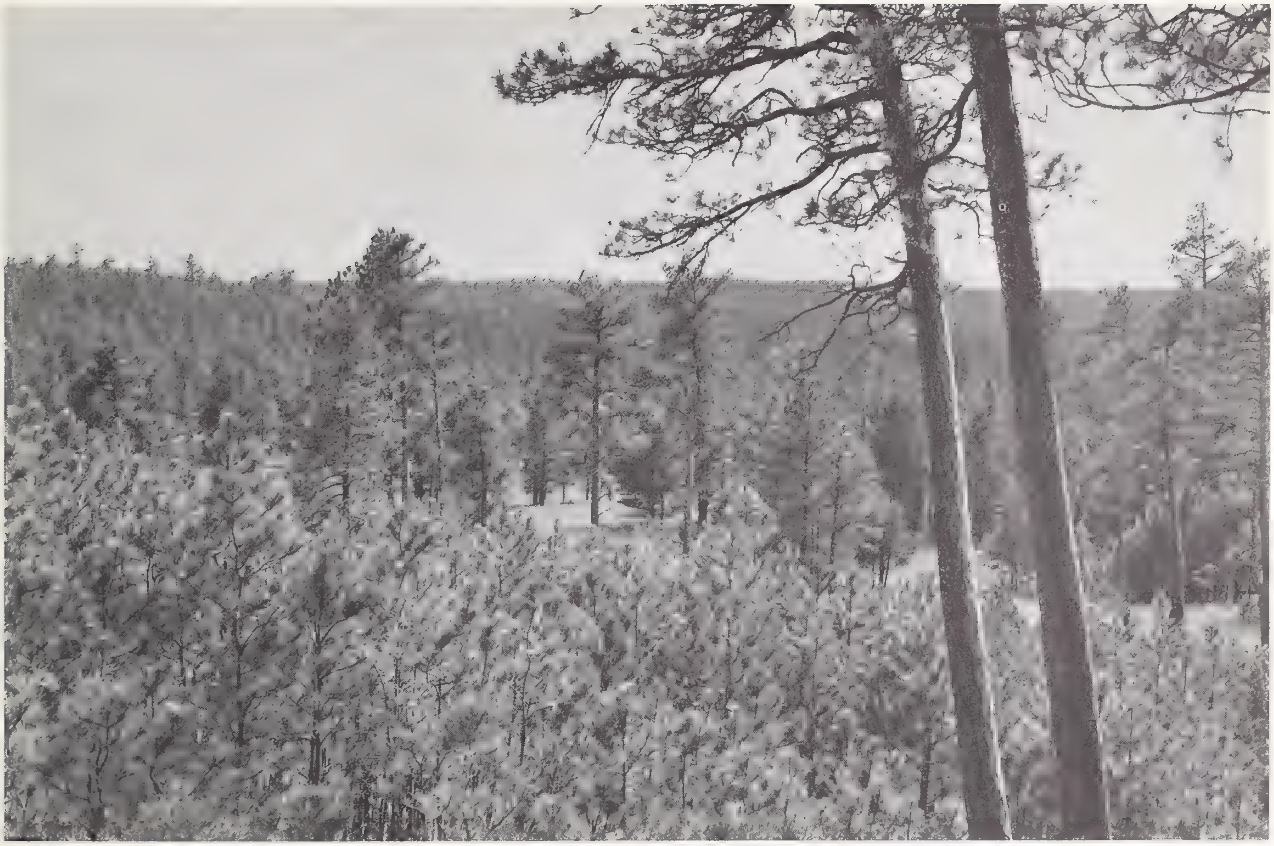
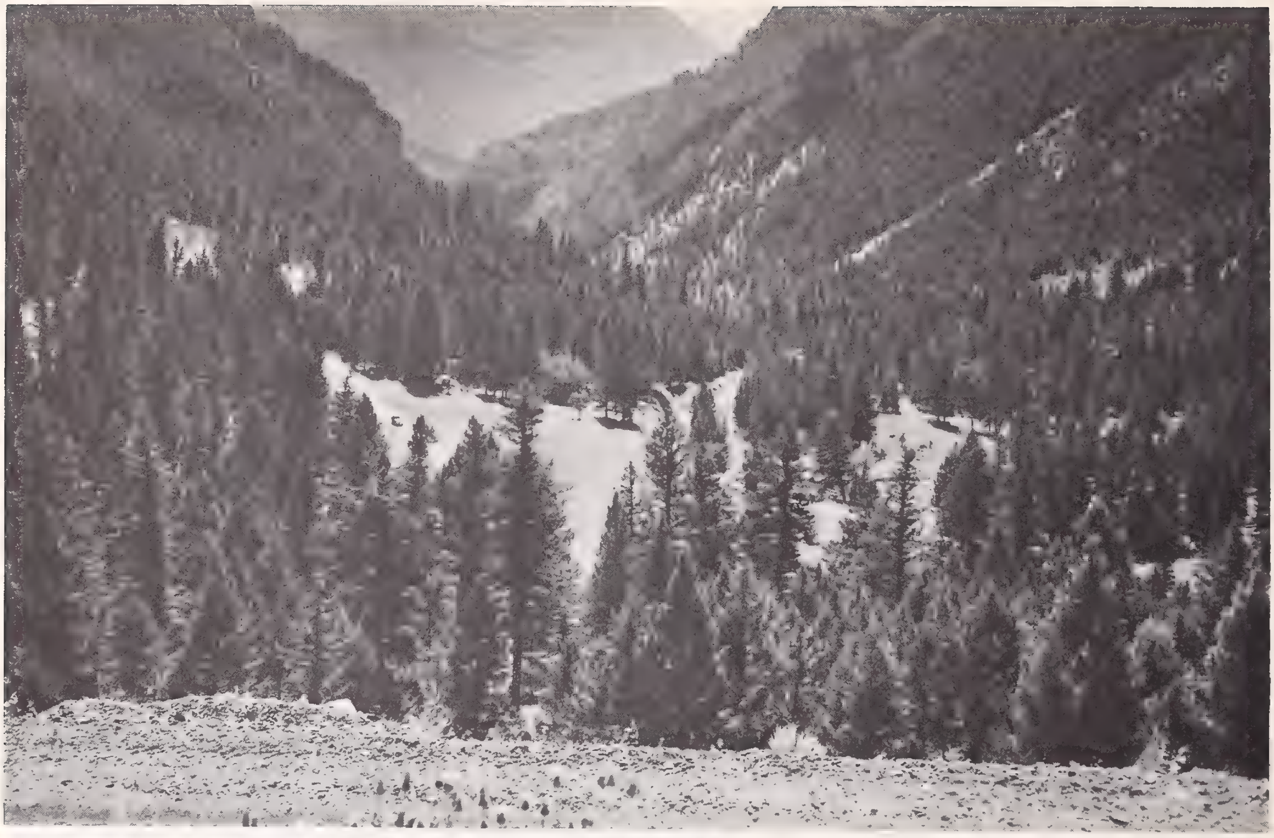


Figure 3.--Ponderosa pine stand on Custer National Forest in eastern Montana.

In the Douglas-fir climax zone, (fig. 4) stands grow moderately fast, are dense, and produce the most important commercial species in Montana: Douglas-fir, often mixed with ponderosa pine, western larch, or lodgepole pine. This zone occupies a large portion of the forested areas in the Montana Rocky Mountains.

The grand fir and cedar-hemlock climax zone, (fig. 5) the most productive forest land, with many moisture-loving species in the understory, is restricted to the northwest corner of the State. In the more moist and least disturbed areas of this zone, the climax species cedar and hemlock predominate. However, where disturbed by wildfire much of this forest zone is presently occupied by western larch, western white pine, and spruce. A mixture of species is common in this zone, but total acreage of the zone is small.

The temperate spruce-fir zone (fig. 6) is also relatively productive. In the moistest portions, such as stream bottoms and poorly drained benches at moderate elevations, spruce is the only successful conifer. In other areas, subalpine fir is the probable climax species and lodgepole pine or western larch may be the dominant overstory trees.



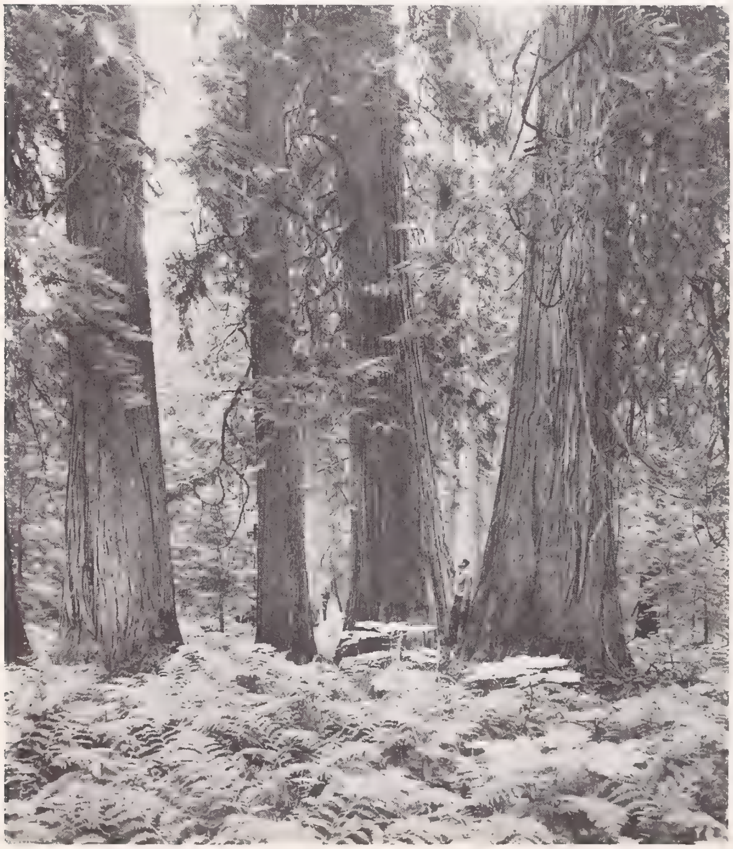


Figure 4.--Douglas-fir stand on Helena National Forest.

Figure 5.--Giant cedars with luxuriant undergrowth in northwestern Montana.

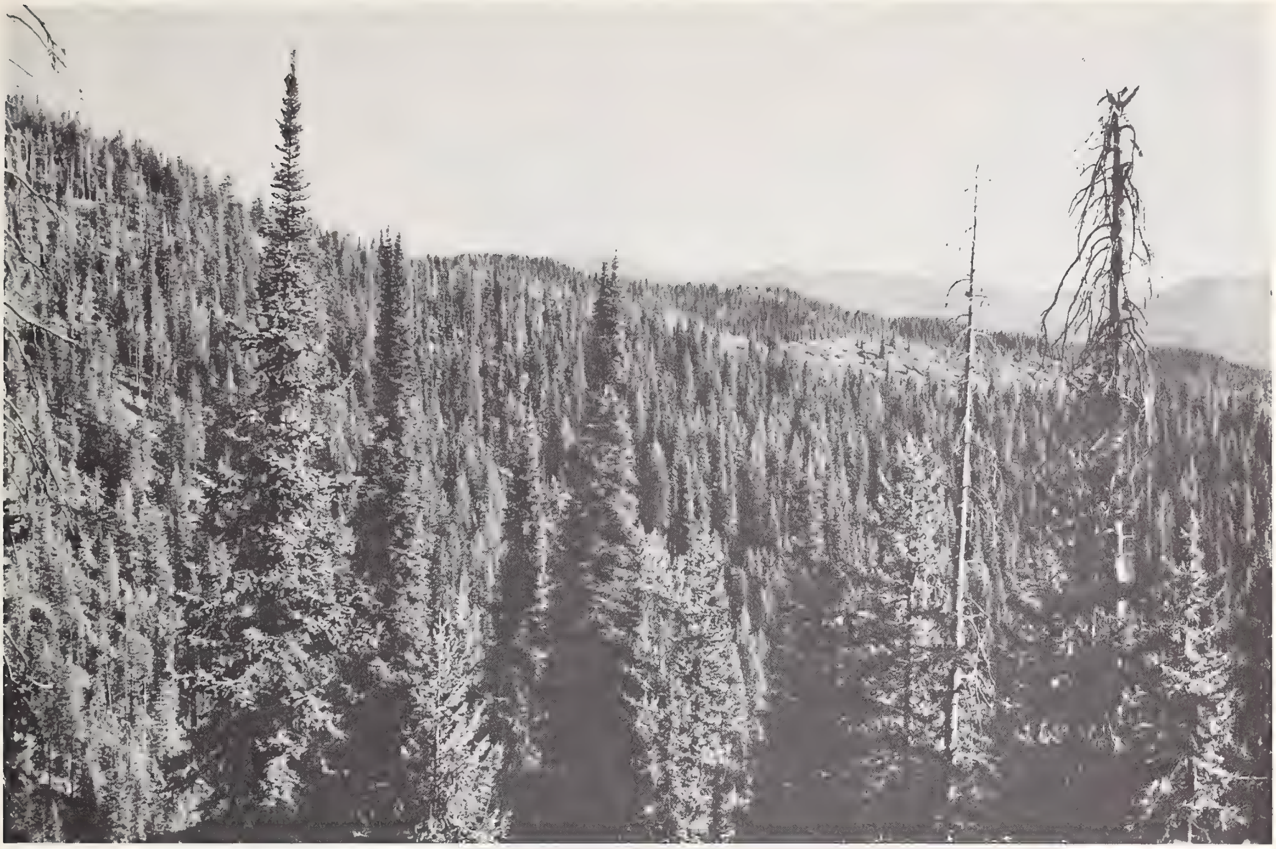


Figure 6.--Spruce-fir forest on the Montana-Idaho border.

The subalpine zone is the highest and forms the upper timberline. In this cold, snowy environment little timber or cattle forage is produced, but the zone yields high amounts of water and wildlife food and cover and is highly prized for recreation.

In each of these broad zones, there are many habitat types that have unique combinations of understory vegetation. The habitat types are providing an increasingly refined basis for evaluating land capacity for wildlife, water, recreation, timber, and other uses.

Montana's forest lands vary from scattered bottomland stringers of cottonwood in the eastern portions of the State to large, dense stands of pine, fir, and other coniferous species on mountain slopes in the western portion. Forests are more dominant west of the Continental Divide, where they cover 80 percent of the total land area, as compared with east of the Divide, where forests cover 12 percent of the land (fig. 7).

Ownership is of particular significance in analyzing Montana's forest resource because there are some striking differences in laws, policies, and management objectives among various forest owners. The Federal Government manages about 17 million acres of Montana's forest land. Another 5.7 to 7.3 million acres (depending on the definition of "forest land") is in private and

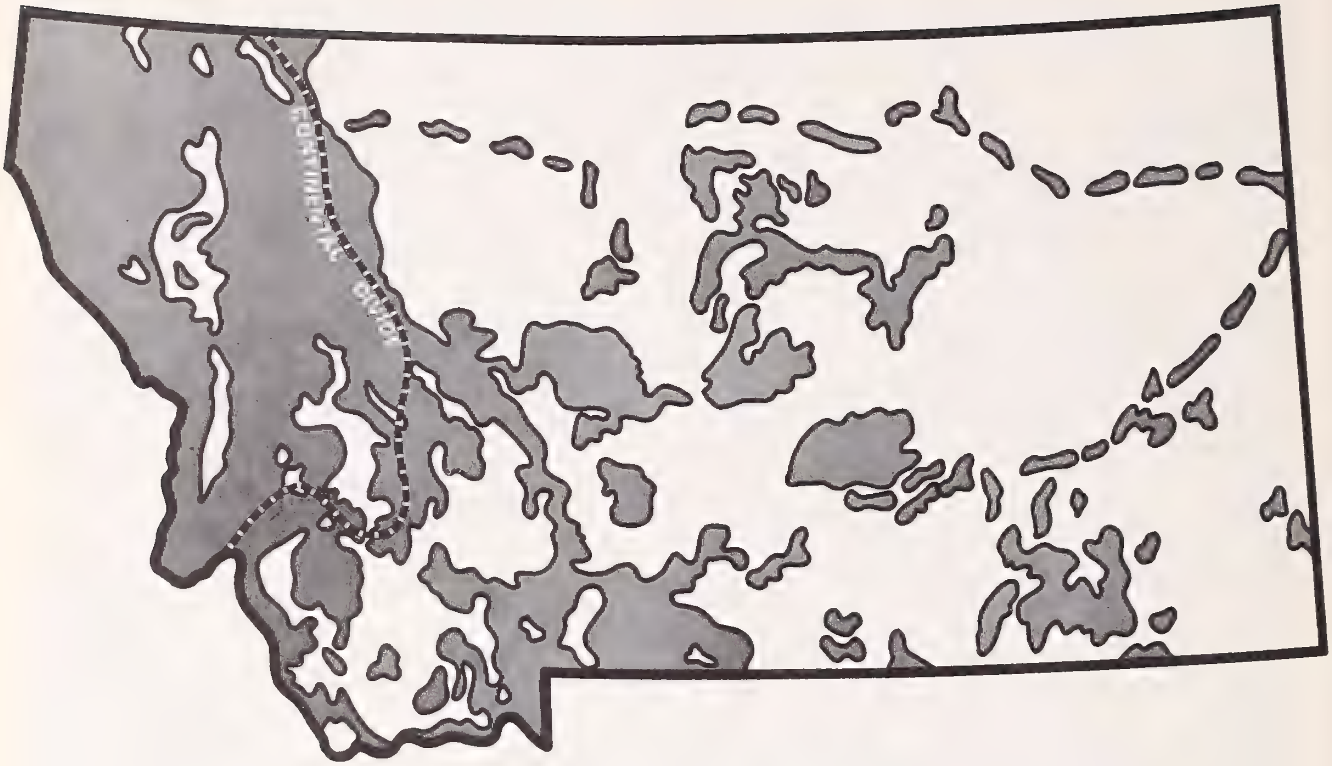


Figure 7.--Forested land in Montana.

State ownerships. The approximate ownership pattern (USDA Forest Service 1973a) for forest lands is:

	Thousand acres	*Percent*
National Forests	16,526.7	72.6
Bureau of Land Management	478.0	2.1
Miscellaneous Federal	53.1	.2
Total Federal	17,057.8	74.9
Indian (including land held in trust by BIA)	620.2	2.7
State	529.5	2.3
County and municipal	4.7	--
Forest industry	1,055.4	4.6
Farmer	1,952.4	8.6
Other private	1,557.6	6.8
Total Non-Federal	5,719.8	25.1
All forest land	22,777.8	100.0

The ownership pattern of Montana's forest lands has changed over the years as public lands have been acquired, sold, or exchanged and as private lands have changed hands. Changes have occurred as environmental concerns have grown and as utilization technology has changed. The most significant change, however, has been how land is classified through legislative action and administrative regulations. Total acreage of forest land has remained fairly constant, but Wilderness and Primitive Areas, and acreages of deferred, special, and marginal commercial forest have increased, while acreage of the principal timber-producing standard commercial forest land has decreased. Over time, the categorization of Montana's forest lands changed in the following manner:

	1949	*1963*	*1970*
	- - -(*Million*	*acres*)- - -	
Standard commercial	15.8	16.8	12.5
Special, deferred, marginal	--	.1	3.4
National Parks, Wilderness, Primitive	2.4	2.3	2.9
Noncommercial	4.2	3.8	4.0
Total	22.4	23.0	22.8

(Sources: USDA Forest Service 1973a; Regional Office data; Hutchison and Kemp 1952)

National Forests are the largest single ownership of forest land in Montana, totaling over 16 million acres. A critical look at land capabilities has led to new definitions of commercial forest land, and some roadless areas have been identified for study as to their potential for inclusion in the National Wilderness Preservation System. At the end of 1973, when less than one-seventh of the scheduled land-use planning had been completed, approximately 36 percent of National Forest land was considered "standard commercial forest land," ready, available, and suitable for normal timber production, using standard harvesting practices and precautions. The status of National Forest lands in 1973 was as follows:

	Million acres	*Percent*
COMMERCIAL FOREST LAND		
Standard (available and suitable for timber production with present technology)	6.0	36.4
Special (needs special timber production measures to protect other multiple use values)	.4	2.6

(Con. next page)

	Million acres	*Percent*
COMMERCIAL FOREST LAND		
Marginal (areas not presently scheduled for harvest because of excessive development costs, low product values, or resource protection constraints)	2.5	15.2
Deferred (includes 0.5 million acres of New Wilderness Study Area, plus 0.3 million acres previously deferred)	.8	4.8
Subtotal commercial	9.7	59.0
NONCOMMERCIAL AND MISCELLANEOUS	4.9	29.5
WILDERNESS	1.5	9.0
PRIMITIVE	.4	2.5
Total	16.5	100.0

(Source: USDA Forest Service 1973a and Regional Office data)

The Bureau of Land Management manages more than 8 million acres in Montana. This includes 827,000 acres of forest or wooded land, of which about 40 percent is commercial forest land (USDI Bureau of Land Management 1972):

	Acres
Commercial forest	334,000
Woodland	493,000
	827,000
Non-Forest	7,319,300
Total public lands administered by BLM	8,146,300

New criteria and guidelines together with updated resource information are continually modifying the use patterns of these BLM public lands; for example, two primitive areas, one geologic area, and a refuge area for wild horses have been established.

The Bureau of Indian Affairs administers over 620,000 acres of forest land. Over 70 percent of this is on the Flathead Reservation in western Montana, and the remaining forest lands are on the Crow, Northern Cheyenne, Blackfeet, and Rocky Boy reservations.

Montana's two National Parks--Glacier and a portion of Yellowstone--include nearly 1 million acres of forest land that is reserved from commercial timber production. These components of Montana's forest land play a major role in the recreation industry, and also influence the management and use of adjacent forest lands. These impacts are discussed in more detail in a later section.

The State of Montana owns about one-half million acres of forest, administered by the Division of Forestry, Department of Natural Resources. Most of the State forest land is at the lower or middle elevations and much has been logged.

Burlington Northern, Inc.; U.S. Plywood, a division of Champion International; and St. Regis Company account for three-fourths of the private forest land. Remaining forest land is in holdings ranging from smaller industrial holdings of several thousand acres, to small woodlots of a few acres. Private lands are mostly at lower elevations, are readily accessible, and most have been previously logged.

The Wilderness Resource

In 1964, the National Wilderness Preservation System was established to preserve undeveloped Federal lands. Each Wilderness area was to have the following characteristics:

(1) Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;

(2) Has outstanding opportunities for solitude or a primitive and unconfined type of recreation;

(3) Has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and

(4) May also contain ecological, geological, and other features of scientific, educational, scenic, or historical value.

By 1974, six areas in Montana had been legally designated as Wilderness. Another four areas had been administratively classified as Primitive Areas, to be managed essentially as Wilderness. The 10 areas encompass more than 2 million acres.

All National Forest areas that are roadless and at least 5,000 acres in size have been identified. Of these 4.9 million acres, 1.6 million acres have been identified as New Study Areas slated for intensive evaluations as future additions to the National Wilderness Preservation System. Although the areas under study include about 500,000 acres of commercial forest land, all timber harvesting has been deferred until the detailed studies have been completed. Portions of National Forests classified as Wildernesses and Primitive Areas, and the New Study Areas are shown in figure 8. Timber harvesting has not been formally deferred on the other roadless areas, but none will occur until after the completion of management plans and the filing of Environmental Impact Statements with the Council on Environmental Quality.

The Wildernesses and Primitive Areas in Montana include some of the most spectacular scenery in the mountain West and provide excellent hiking, fishing, and hunting (fig. 9). In addition, the areas provide natural laboratories for observing and studying plant and animal communities undisturbed by human development and are important watersheds. Mining is still permitted under regulations more stringent than in the past.

The Natural Area Resource

Throughout the Nation, Natural Areas are being established to provide areas where man's disturbance is minimized and to allow natural processes to dominate. Ecosystem conditions are preserved and scientific and educational use is encouraged. Unlike restricted-use lands such as parks, game refuges, or Wildernesses, recreational use and commercial use of Natural Areas are generally prohibited.

A Montana Natural Areas Committee, representing public and private groups concerned with land management, was formed in 1973 to coordinate Natural Area establishment. This committee through its various working groups defined Natural Areas as "areas of land or water representing significant natural features or processes, which are designated for their scientific and educational values."

To date, five Research Natural Areas have been formally designated on Federal lands in Montana:

	Acres
Coram Research Natural Area (Flathead N.F.)	635
Cliff Lake Research Natural Area (Beaverhead N.F. portion)	2,301
Cottonwood Creek Research Natural Area (Beaverhead N.F.)	128
Poker Jim Research Natural Area (Custer N.F.)	363
Sheep Mountain Research Natural Area (Red Rock Lakes National Wildlife Refuge)	85

Portions of several other special use areas have been designated as potential future natural areas.

The Montana Natural Areas Act of 1974 has provided special emphasis for including State-owned lands in the Natural Area system. It also enables the State of Montana to develop a complete system of Natural Areas through cooperation with other agencies and private individuals.

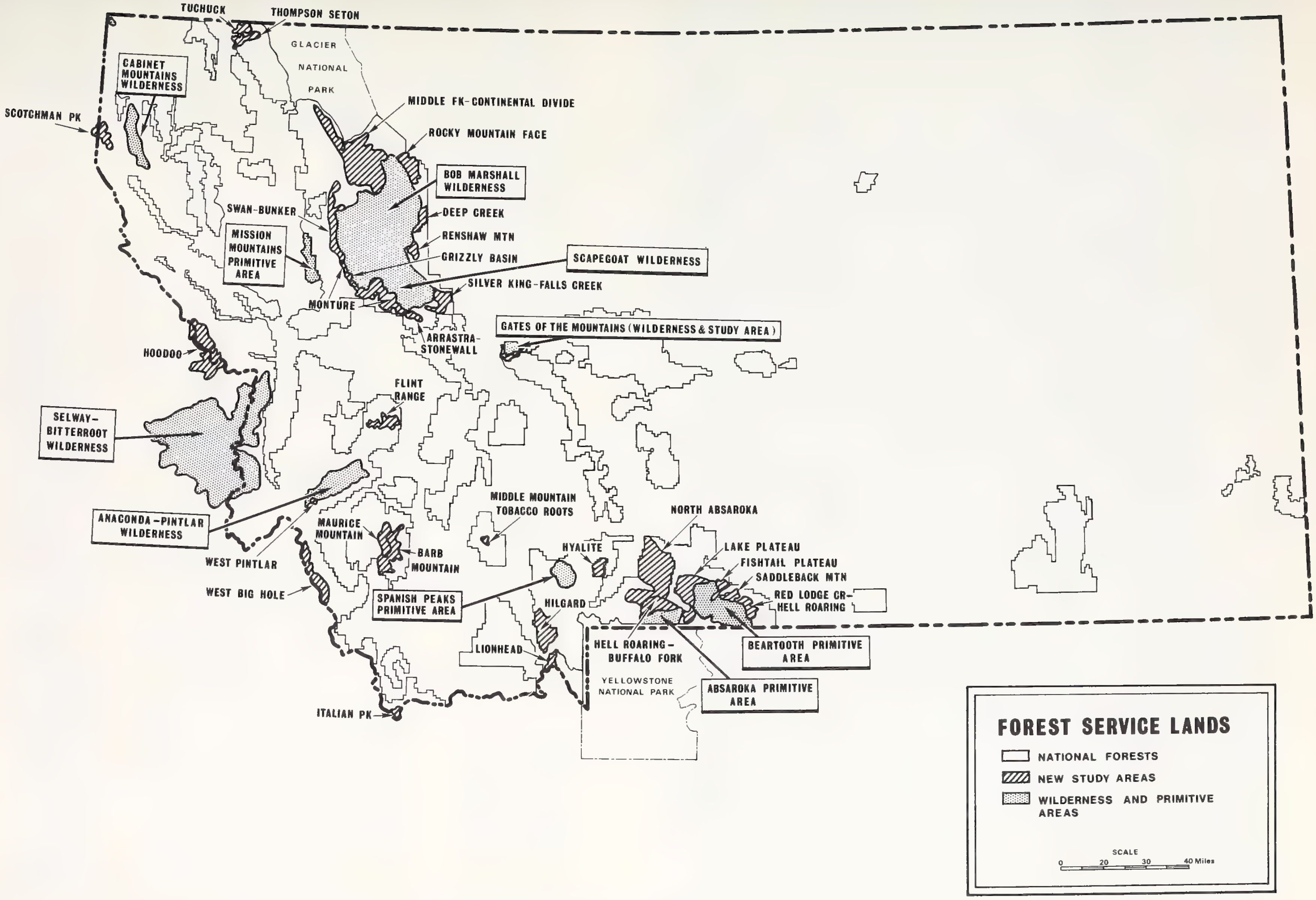


Figure 8.--Lands managed by the Forest Service in Montana.

Figure 9.--Hikers in Gates of the Mountains Wilderness on the Helena National Forest.

The existing Natural Areas and those that are established in the future will likely not be a large total acreage. But they potentially will serve a big role in providing benchmarks for comparison as more and more of the natural ecosystems on other forest lands are altered or disturbed.

The Recreation Resource

Outdoor recreation has become a major national pastime, and Montana forests offer millions of acres of prime recreation land. Defining forest land as a recreation resource is an elusive and subjective task, partly because it is often difficult to decide what portion of outdoor recreation should be attributed to the forest resource (Is boating in a mountain lake a forest recreation?), and partly because recreation use is not well documented. Then, too, forested lands support more than just the recreation sites and activities in or adjacent to forest lands. For example, many subdivisions for recreation and second homes wouldn't take place without the attraction of forest recreation opportunities and scenic forest backdrops.

"How big" is the forest recreation resource? It is as big and diverse as man perceives it to be. One view is that virtually all of the 23 million acres of forest land in Montana provide recreation, ranging from picnics in scattered groves at the edge of grasslands, to hunting in heavily timbered slopes, to mountain climbing at timberline. At the other extreme, the forest recreation resource might be seen as about 3 million acres in Montana in which recreation is a major use. Much of this is in Wilderness and Primitive Areas and National Parks:

	Million acres (forest land)
Wildernesses and Primitive Areas	1.9
Glacier and Yellowstone (portion) National Parks	.9
Other campgrounds, recreation areas, etc. (estimated)	.2
	3.0

Another measure of the recreation resource is the developed sites that are available for forest recreation (or at least recreation within a forest setting). An accurate count is not available, but we estimate there are nearly 800 developed sites that are related to forest lands.[2] We categorized the sites as follows:

Campgrounds	505
Picnic areas	85
Boat-swim-fish access	60
Lodges and resorts	40
Winter sports	29
Other (scenic sites, nature displays, etc.)	55
	764

In addition, more than 1,700 private recreation residences are located on leased public forest lands. Residences on private forest lands would undoubtedly number in the thousands. For example, there are nearly 5,000 rural, nonfarm second homes in the State, and over 2,300 of these are in the 17 westernmost forested counties. It would be reasonable to assume that many of these are used for forest-oriented recreation.

The number of public facilities on National Forests, National Parks, and other public lands hasn't changed much in recent years--for example, in National Forests, facilities other than private residences totaled 508 in 1965, as compared to 483 in 1971. This includes a net decrease in some types of camping and picnic facilities. However, total capacity (in terms of "persons at one time") has remained about the same. On the other hand, privately owned campgrounds have become much more common in the past decade, and construction or expansion of several large resort complexes is underway at areas like Big Sky (near Bozeman) and Big Mountain (near Whitefish).

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[2] Data for public lands were taken from internal reports. Data from private sites were developed from a commercial directory and from a Montana Fish and Game Commission report (1974).

Roads and trails are a vital part of the forest recreation resource. National Forests offer 17,000 miles of roads and 14,000 miles of trails, and the road system has increased steadily. Trail mileage has declined as roads and aircraft have reduced the need for trail access for management purposes, despite the rapid growth of recreation use. In other instances some roads and trails are closed for visitor safety and to protect the land resource. Mileages vary from year to year.

	Roads	*Trails*
	(Miles)	
1966	14,524	14,761
1967	14,923	14,680
1968	15,353	14,550
1969	15,767	14,191
1970	16,138	14,189
1971	16,677	14,241

Some roads and trails have been developed specifically to serve recreation purposes, but most of them were built more than three decades ago for timber harvesting, or management and protection.

The Grazing Resource

Forest land provides grazing for livestock, and thus contributes to agriculture, Montana's number one industry. There are about 65 million acres of grazing land in the State, about 11.5 million acres of it grazable woodland (USDA Forest Service 1973a):

	Private	*Public*	*Total*
	(Million acres)		
Grazable woodland	4.4	7.1	11.5
Rangeland	41.6	11.2	52.8
Total	46.0	18.3	64.3

A recent study of grazing suggests that more than half of the forested lands in Montana could support grazing without undesirable side effects (Forest-Range Task Force 1972). Summer grazing in the higher elevation forested lands complements the winter and spring grazing on lower elevation lands (fig. 10).

As in many agricultural activities, rangelands and grazing have become less important nationally as cattle raising has shifted away from extensive operations to more intensive ones such as feedlots (USDA Forest Service 1970). However, grazing in forest land for wildlife as well as domestic livestock remains locally important; management of forest grazing lands is certain to come under increasing concern for the environment and pressures for alternative uses of land. The demand for second homes in forest areas, as well as expansion of towns and residential areas, very often means lots and "ranchettes" of 1 to 20 acres being developed in the lower elevation fringe of the forest range resource. The land values that develop for this type use usually mean

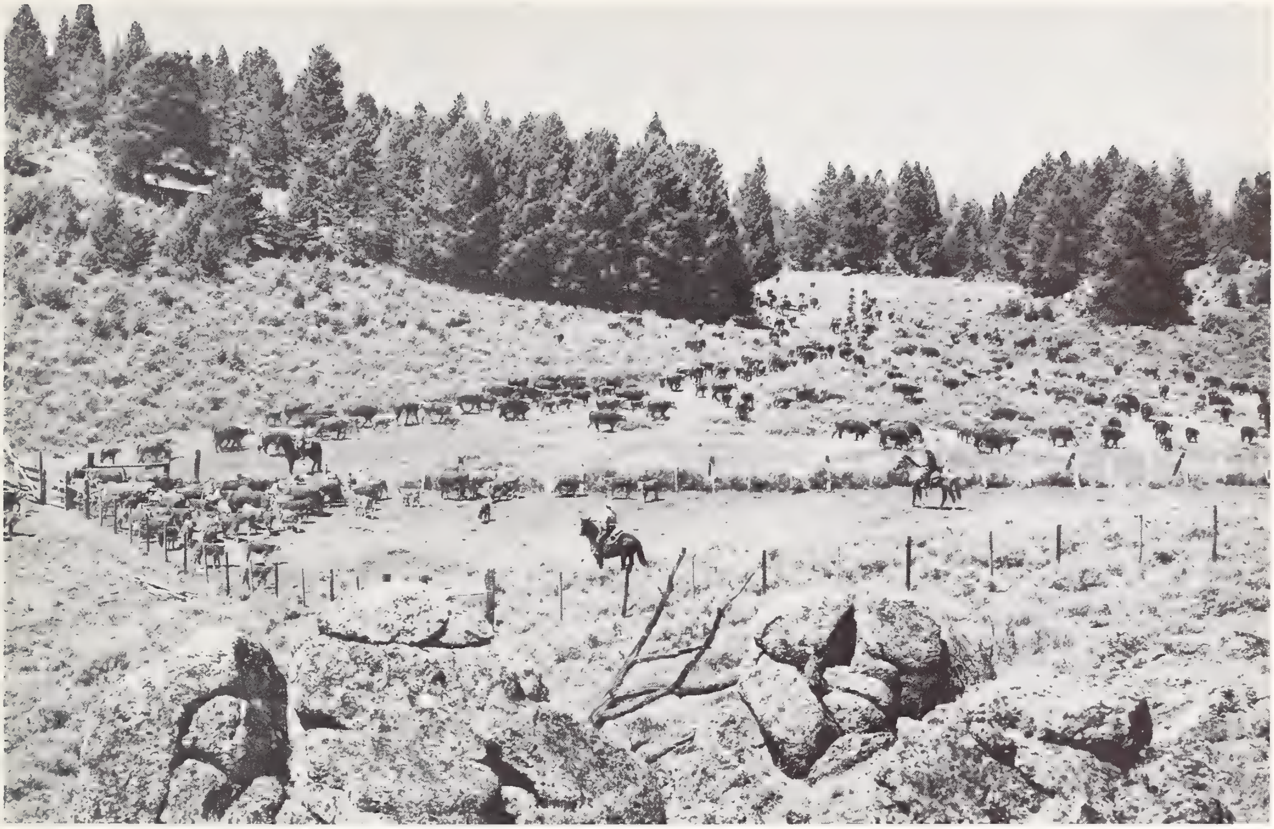

Figure 10.--Cattle being counted onto National Forest range for summer grazing.

an end to grazing and a major change in the nature of the land. The Bitterroot Valley is a prime example of this type of development, where forested lands that are assessed at relatively low rates as timber and grazing areas are assuming residential property valuations.

In a few areas, especially on the Lewis & Clark National Forest, timber harvesting is apparently converting marginal commercial timberland to grazing land. But more commonly, forest-related grazing occurs in meadows that are administratively part of a forested area, and in some habitat types there is a natural encroachment of trees on meadows. Other grazing takes place during the early years of stand development. As the crowns close, forage production declines.

The Wildlife Resource

Nearly every forested acre of Montana provides habitat for some species of wildlife. Used in this context, wildlife is defined as "all wild vertebrate animals." Wildlife includes 540 species of mammals, birds, fish, reptiles, and amphibians in Montana (Davis 1965). Of this number of animals, almost all are dependent on the forest for existence. For example, the paddlefish in the lower Missouri and Yellowstone River systems is just as dependent on the quality and quantity of water produced in the forested headwaters as is the arctic grayling in the high mountain lakes and streams in southwestern Montana.

Forest lands in Montana offer as great a variety of big game as found in any State. The quality of game animals and hunting experiences available has brought the wildlife resource of Montana's forests national recognition.

A precise count of big game on all of Montana's forest lands is not available. Estimates of some of the principal game animals on National Forest lands and Bureau of Land Management lands, however, give some idea of their numbers. The following estimates include animals that are either highly dependent on forests for food and cover, or that are found primarily in areas managed as forest lands:

	NF	*BLM*
	(Thousand animals)	
Elk	54.1	35.7
Moose	5.1	.2
Whitetail deer	51.3	31.4
Mule deer	172.5	93.3
Grizzly bear	.5	--
Black bear	12.9	.7
Mountain goat	4.8	.3
Bighorn sheep	2.2	.4

(Source: National Forest and Bureau of Land Management annual reports)

Populations of big game fluctuate from year to year, but in general have held fairly constant over the past decade.

Game distribution maps generally show the mountainous and timbered areas of the State as producing the greatest variety of species. Generally, big game spend most of the year in forested areas until deep snow drives them to the lower elevation winter ranges (fig. 11). Portions of game ranges have been identified as critical for survival of certain species.

The Fish and Game Commission owns or leases 153,000 acres of big game range, most of it in the west and central portions of the State, to provide winter range for animals that summer in adjacent mountain forests. Farther east, in the upper Missouri River basin, about 40 percent of the area classed as forest and woodland is considered key game habitat (155,000 acres of key big game range and 55,000 acres of key upland game range).

Winter range has been the critical factor in deer and elk management; the forested summer range is generally abundant and therefore less critical. However, forest land management is of vital importance to wildlife because management decisions involving both winter range and summer range are usually

Figure 11.--This bull elk is part of a large herd that summers in Yellowstone Park and winters on the Gallatin National Forest.

interdependent. In addition, timber harvesting and attendant roadbuilding raise important but as yet largely unanswered questions as to the net effect, positive or negative, on big game populations. Several studies on this impact are now underway, but until the results are available, decisions as to responses and trade-offs involving wildlife and other resources such as timber will be largely subjective.

There is a direct physical relationship between forest lands and fishing waters. Roadbuilding, timber harvesting, and similar activities can disrupt, at least temporarily, fishing waters through physical changes of streams, or through silting that affects spawning or food. Also, streams attract fishermen whose presence requires that parking and camping facilities be provided. An inventory on National Forests in Montana shows the following acquatic resource:

	NF land	*All lands*
Fish habitat:	13,032 miles (7,135 fishable)	15,000 miles
Lakes and impoundments:	128,400 acres (1,300 in number)	482,000 acres

The real value of wildlife that inhabit forest lands can only be told by the thousands of people who take to the woods for their fall hunt or who simply enjoy watching or photographing animals of all kinds in their native habitat. The numbers of people and dollars involved, however, do provide a useful measure of the role wildlife plays as a part of the forest resource. These are examined in more detail in a later section.

The Water Resource

Water has been called the most important product of the forest lands of the West. In Montana the forested mountains are the principal source of major streams. The Missouri and Yellowstone Rivers, which provide both hydroelectric power and irrigation water for much of the drier eastern part of the State, are fed by small streams originating in forested mountains. In the Columbia River drainage west of the Continental Divide, the water produced is used for irrigation and power generation.

Total water produced in Montana is about 37 million acre-feet per year. Perhaps half of this total comes from the National Forests, which lie at higher elevations. Other lower elevation forest lands do not receive as much precipitation, but all forest lands together probably yield two-thirds of the State's water.

Much of the water falls as snow. Ability to manipulate water yields through timber-harvesting practices and cloud seeding has been demonstrated for small areas but is still in the experimental stage for large basins. Water yields are most directly related to elevation, topography, and exposure to prevailing weather systems.

Managing the water resource also involves resolving several problems. Harvesting of timber can accelerate the spring runoff of the snowpack; therefore, the harvest within a given drainage must be planned to avoid floods. In addition, watershed damage resulting from earlier, poorly planned logging activities and from the large fires that occurred, particularly in the first half of this century, requires soil stabilization work (Packer 1959).

The Mineral Resource

Although minerals are not usually considered a forest resource, mining often has a big impact on forest cover and other forest resources. National Forests in Montana hold numerous mineral claims and leases. Recent changes in mining laws have increased Forest Service authority over the disposition of timber and protection of the environment on most of these claims.

In the eastern part of the State, mining has begun on parts of the vast coal reserves underlying about 800,000 acres. About 85 percent of this is cropland and pasture, and range, but some forested land and grazing lands administered by the Forest Service are involved (Coordinating Committee, North Central Power Study 1971). Various private interests, environmental groups, and landowners are currently debating the legal and environmental aspects of strip mining this coal.

The strip mining already underway and proposed expansions will have a substantial impact on forest resources. For example, in the Tongue River drainage of southeastern Montana (including Ashland, Birney, and Decker), a preliminary recommendation was made to permanently reserve from strip mining about 20 percent of the federally owned coal deposits because of unacceptable impacts on the values associated with water yields, grazing, and recreational activities. In addition, it was recognized that mining on the remaining lands would adversely affect these and other forest-related values (USDI Bureau of Land Management 1974).

An effort is underway to develop data and guidelines for the proposed mining activity through the federally supported program SEAM--Surface Environment and Mining. This multidisciplinary effort headquartered in Billings is leading the development of techniques to minimize impacts of strip mining on the land resource and to more satisfactorily rehabilitate disturbed areas.

Forestry Education

To develop the skilled manpower needed to manage forest resources, there is an active and diverse program of forestry education in Montana. The University of Montana at Missoula has graduated over 3,000 foresters, and the School of Forestry is now one of the largest schools in the University. In addition to traditional forestry subjects, land use, environment, and public administration receive major emphasis.

In addition, the Missoula Technical Center offers 1-year and 2-year technical forestry programs at post-high school level. In recent years enrollment has been about 50 students; several hundred students have graduated. Surveying, timber scaling and cruising, and similar technical activities are the primary focus of this program. Flathead Valley Community College in Kalispell also offers a similar technical program and in addition offers professional preforestry college courses.

CHAPTER II

TIMBER MANAGEMENT AND PRODUCTION

In this section we describe the timber resource, how it is managed, levels of timber harvesting, and possible changes in timber production.

The Commercial Timber Resource

One of the basic considerations of forest land as a timber resource base is its productivity--that is, its capacity to grow usable wood. Montana's forest lands have been classified for productive capacity, and although some land is highly productive, most is in the middle or lower end of the range of growth potential (USDA Forest Service 1973a):

Growth potential per acre per year (ft^3)	*Montana*	*Rocky Mtns.*	*Oregon and Washington*	*United States*
		(Percent)		
165 or more	2	2	15	3
120-165	9	6	21	8
85-120	25	14	20	23
50-85	30	25	36	39
20-50	34	53	8	27
	100	100	100	100

In productivity, Montana's forested land compares favorably with the Rocky Mountain region and the United States as a whole, but is far less productive than the forested lands in Oregon and Washington.

Although these figures provide a first approximation of the capacity to produce wood, they are not totally satisfactory for estimating what the land could produce under more intensive forest management. It has been estimated, for example, that with adequate funding intensive management could double the production of timber on National Forest lands (Green and Setzer 1974).

In the short run, the current inventory of merchantable timber is of greatest concern in defining what could be harvested. In 1970 there were over 33 billion cubic feet of timber, about half in sawlog-size materials:

Class of timber	*Volume (Billion Ft^3)*	*Percent*
Sawtimber trees (9 in + d.b.h.)		
Sawlog portion	17.8	54
Upper stem portion	1.8	5
Pole timber trees (5-8.9 in d.b.h.)	9.0	27
Subtotal growing stock	28.6	86
Rough and rotten trees	1.5	4
Salvable dead	3.0	9
Total	33.2	100

An examination of individual species (fig. 12) shows that most of the growing stock is in lodgepole pine and Douglas-fir. Of the two, Douglas-fir

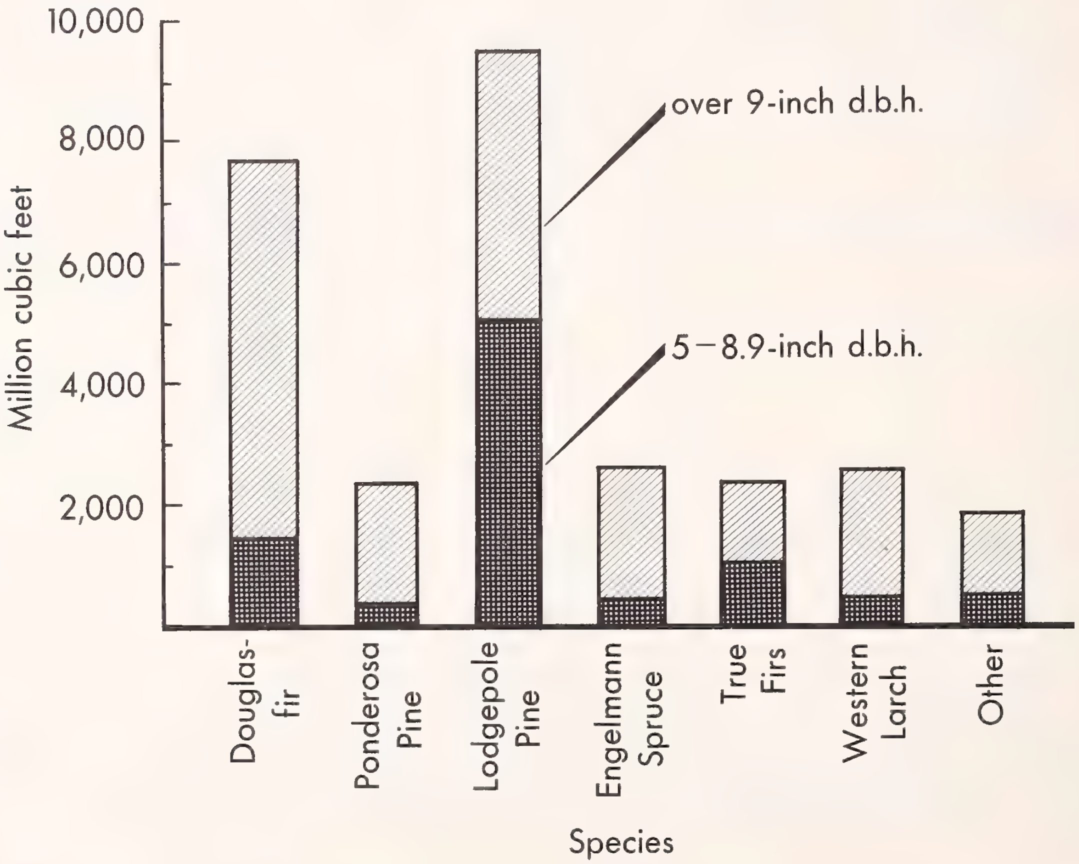

Figure 12.--Net volume of growing stock on commercial forest lands in Montana by species and size class, 1970. (From Green and Setzer 1974).

has been exploited far more heavily and is the State's most important commercial species. Most of the volume of all the principal species is in trees over 9-inches in diameter--Montana still is harvesting an old-growth resource.

Because of sampling errors and because the criteria defining commercial timber have changed, comparing inventories over time is difficult. However, available data indicate that the inventory in Montana of growing stock--all live (noncull) green trees expressed in cubic feet and sawtimber expressed in board feet of sawlogs--has remained relatively stable over the past two decades:

	All growing stock (*Billion* ft^3)	*Sawtimber* (*Billion bd. ft.*)
1953	27	101
1963	29	108
1970	29	102

(Source: USDA Forest Service 1973a).

From 1952 to 1970, growth rates and mortality of all growing stock remained about the same; net growth was about 1.5 percent of growing stock volume. In these same years, removals doubled to more than 1 percent per year. Even with this increase in utilization, in 1970 total growing stock volume was still increasing by an estimated 0.5 percent per year.

The total wood grown in Montana's forests, especially that grown in young stands, far exceeds removals, as shown in figure 13. In 1970, net growth of all growing stock was 443 billion cubic feet and removals 324 billion cubic feet (USDA Forest Service 1973a).

The young growing stands make up a substantial part of the total timber resource. The commercial forest lands of Montana include about 4.5 million acres of pole-size stands and 1.8 million acres of seedling and sapling stands. The real significance of these stands lies in their relatively fast rates of growth and their potential for providing future harvests. Many thousands of acres have been satisfactorily regenerated following harvests or wildfires and, through stocking control and other management efforts, are making good growth. However, there are other acres in need of restocking, thinning, and other cultural efforts.

In older sawtimber stands, which are primarily mature and overmature, removals are slightly greater than growth. From the standpoint of timber production, this is generally desirable because in old stands timber mortality is high and the land produces less wood than it will when converted to younger and more vigorous forests. The growth and removal in sawtimber stands expressed in board feet is shown in figure 14. Sawtimber removals exceed growth primarily on forest industry lands. On public lands sawtimber growth and removals are about equal.

Despite increased harvest, losses of sawtimber to mortality--insects, disease, and fire--are substantial. Mortality has been estimated at about 0.6 billion board feet annually (Green and Setzer 1974).

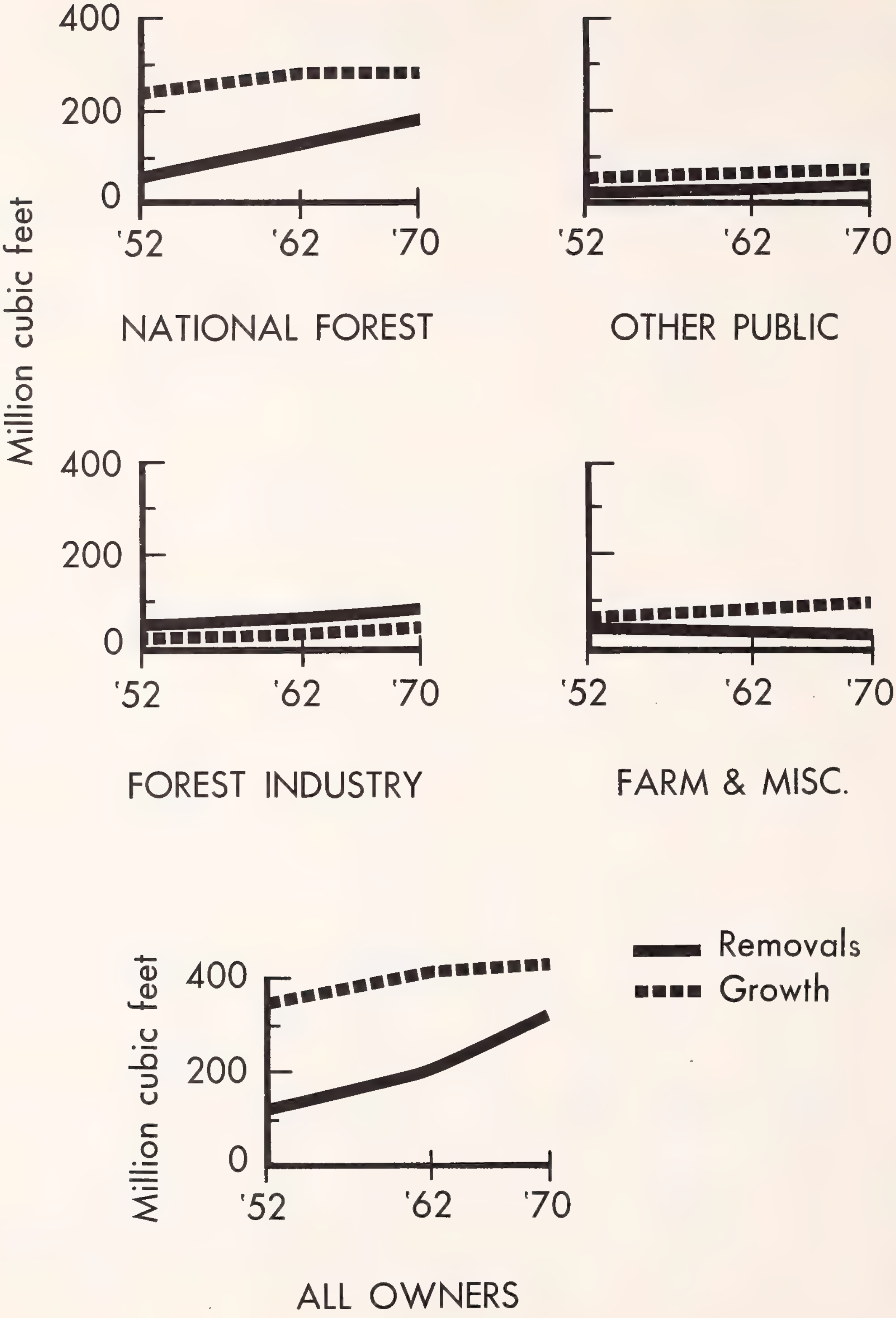

Figure 13.--Net annual growth and removals of growing stock in Montana by ownership.

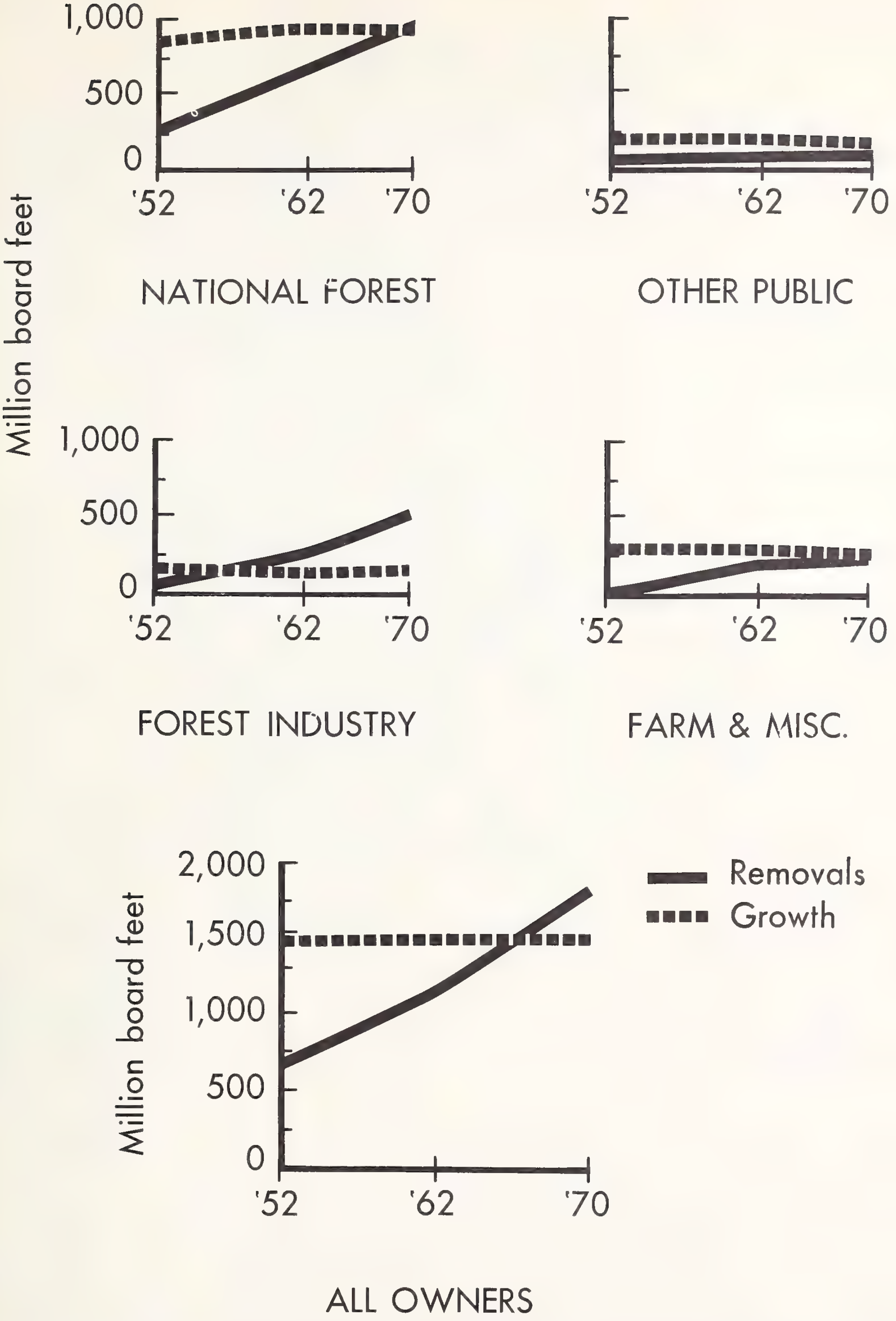

Figure 14.--Net annual growth and removals of sawtimber in Montana by ownership.

The Role of Insects

Several species of forest insects have had, and continue to have, a substantial impact on the forest resources of Montana (fig. 15). Outbreaks of some species of insects are long lasting while others are more transient and localized. Some species cause loss of growth and potential volume; others are outright tree killers. Major insect pests can be categorized either as defoliators or as bark beetles that attack the cambium.

The western spruce budworm probably has had the greatest impact on the forest resource of all species of either the defoliators or the beetles. The budworm has been in epidemic status on more than 5 million acres in Montana since the early 1950's, both east of the Divide in predominantly Douglas-fir forests, and west of the Divide in mixed stands.

Spruce budworm larvae are responsible for serious defoliation and top killing in several commercially important Montana conifers, including Douglas-fir, Engelmann spruce, grand fir, and subalpine fir. Many cutover areas remain nonstocked or require artificial stocking because budworm damage is disrupting the production of cones and seeds. Seed for regeneration is the most immediate budworm-related problem on several forests. In young larch, damage by budworm larvae has reduced annual net height growth by about 25 to 30 percent (Schmidt and Fellin 1973). In one area in the Flathead Valley, between 1967 and 1972 nearly all of the grand fir and subalpine fir and 14 percent of the Douglas-fir were top killed. Budworm defoliation and top killing have also been responsible for significant losses in Christmas tree production and sales.

The larch casebearer, an introduced pest, was discovered in Idaho in 1957 and now is distributed throughout the range of western larch in Montana. Limited studies show that severe damage can cause 75 to 95 percent reduction in growth, although larch can withstand being severely defoliated for several years before dying. The larch casebearer outbreak shows no signs of subsiding in western Montana.

Although the Douglas-fir tussock moth has been of great concern in the Pacific Northwest in recent years, a relatively few acres have yet been found to be infested in the Clark Fork and Flathead River drainages in western Montana. Douglas-fir tussock moths can completely defoliate trees in a single year because the larvae feed on foliage of all ages. Compared to the western spruce budworm and the larch casebearer, the tussock moth is truly a cyclic insect.

In western Montana, the pine butterfly has recently been of considerable concern and has severely defoliated ponderosa pine in some areas. Though the greatest impact has been in the Bitterroot Valley, infestations have been reported throughout the range of ponderosa pine in western Montana. No impact on ponderosa pine stands in central and southeastern Montana has been detected.

Although four insect species have had the greatest impact on the Montana forest resource, several other defoliating species (sawflies on pines, loopers on Douglas-fir and hemlock, needle miners in lodgepole, etc.) cause serious defoliation and growth losses in localized areas from time to time.

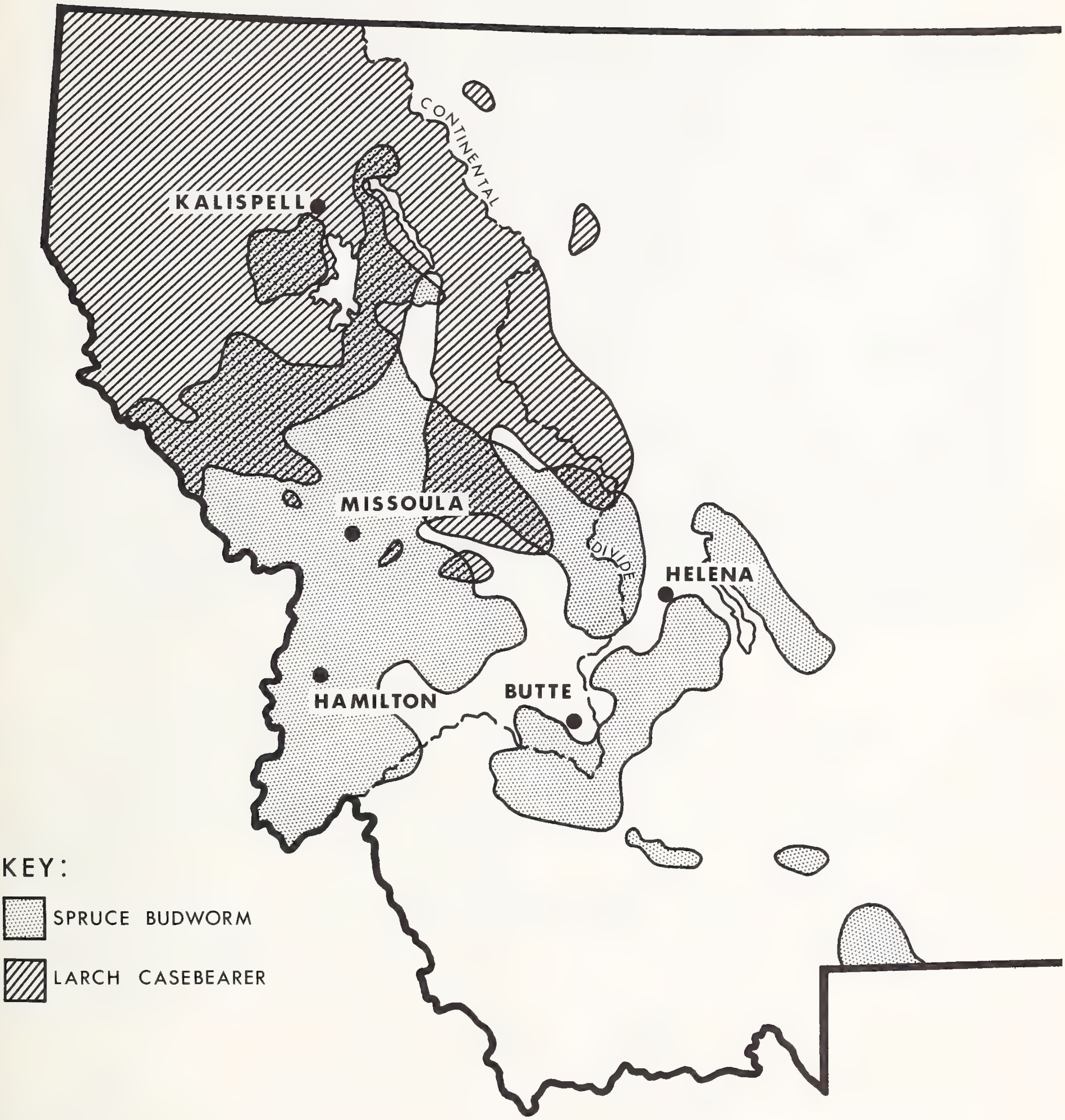

Figure 15.--Distribution of the two most damaging forest insects in Montana.

Among the insect pests classified as borers, the mountain pine beetle, a native insect, has long infested lodgepole, ponderosa, and white pine stands in the Northern Rockies. Most recently, outbreaks have developed in second-growth ponderosa pine stands at many locations in western Montana, resulting in the death of hundreds of young trees (McGregor and Williams 1974). At present there are epidemic infestations of this beetle on the Gallatin, Lewis & Clark, Kootenai, Helena, and Lolo National Forests, and in both Glacier and Yellowstone National Parks. Indications are that this insect will continue to affect the forest resource of Montana.

Not nearly as widespread nor with as great an impact to the forest resource as the mountain beetle in Montana, the Douglas-fir beetle continues to kill trees in relatively small areas at scattered locations in western Montana Douglas-fir stands. At this time, Douglas-fir beetle activity is confined to tributaries of the Clark Fork River drainage east of Missoula and the East Fork of the Bitterroot River.

Pine engraver beetle outbreaks are chronic but usually localized and transient. Recently pine engravers have been a problem in the Clark Fork River drainage and several thousand ponderosa pines have been killed on the Flathead National Forest. Pine engravers have top killed many ponderosa pine on many forests in western Montana. Fir engraver outbreaks in Douglas-fir have been very localized, the most recent on the Helena National Forest.

As harvesting converts mature forests into stands of young trees, insect problems and impacts on the forest resource have changed markedly. In the future, one of the major areas of concern will be in young stands and in areas of regeneration.

During the 1950's, thousands of acres of Engelmann spruce were clearcut to salvage trees killed by the Engelmann spruce beetle. The cutover areas have regenerated naturally or have been planted to spruce. By the early 1970's, the Engelmann spruce weevil, an insect that injures and kills terminal shoots of young trees, was found throughout these young spruce stands in western Montana. In many areas, repeated weevil attacks have killed trees outright or predisposed them to attacks by other insects (McGregor and Quarles 1971).

In west-central Montana, thousands of acres of overstocked lodgepole pine stands are being thinned annually. For the past 10 years, crop trees in these thinned areas have been defoliated by a small weevil. The weevil does not bother mature lodgepole pine--nor does it defoliate trees in nonthinned areas (Fellin 1973). These are two examples of forest insect problems changing with the conversion of mature stands to young trees, and we can expect others.

The Role of Diseases

Forest diseases probably reduce average timber growth in Montana from 8 to 10 percent annually (adapted from Childs and Shea 1967). The diseases responsible for this loss can be broadly categorized, in order of importance, as heart rots, dwarf mistletoes, root rots, canker diseases and foliage diseases. Particularly in lodgepole pine and Douglas-fir stands in the southwestern part of the State, the damage caused by dwarf mistletoes far exceeds that caused by

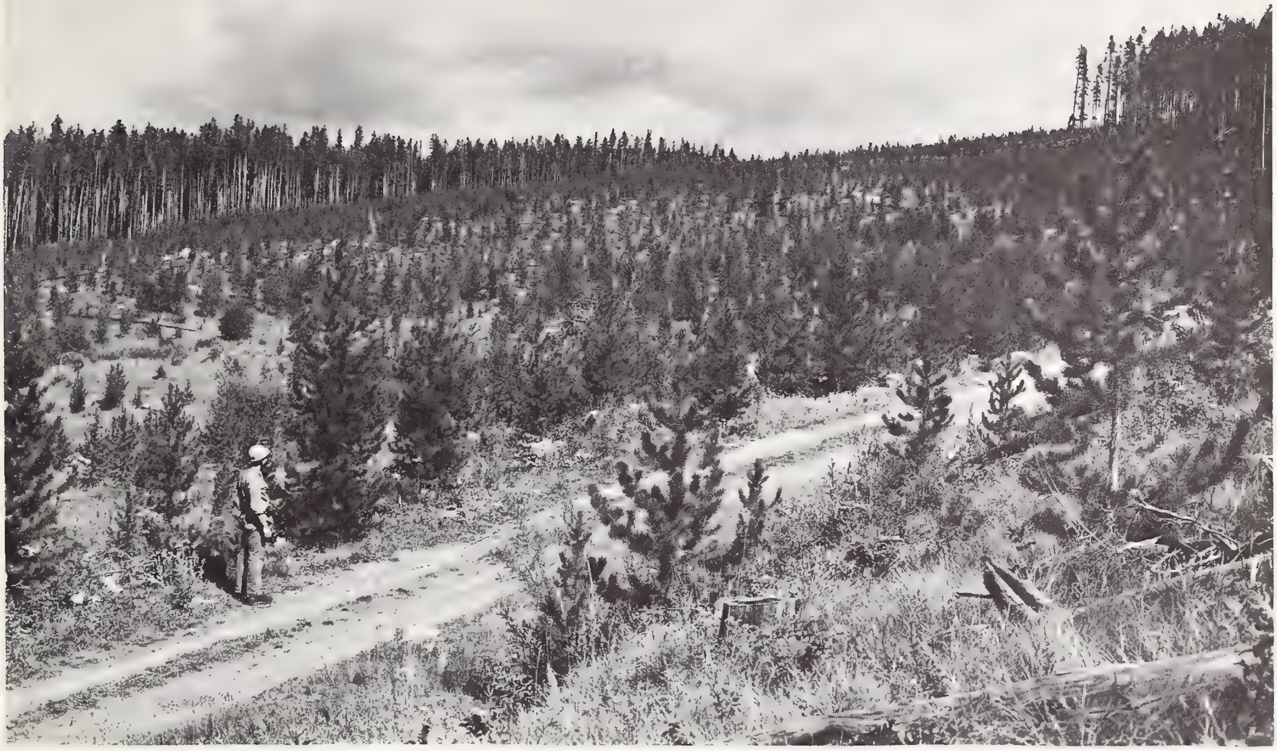

Figure 16.--Thinned stand of 15-year-old lodgepole pine on the Gallatin National Forest. Complete removal of old stand was necessary to insure new stand would be free of dwarf mistletoe.

all other disease agents. To control dwarf mistletoe, the infested stand must be clearcut and replaced by a new stand (fig. 16).

As second-growth management becomes more widespread, losses to dwarf mistletoes will be sharply reduced, but other diseases will become far more prominent. Diseases that begin in wounds or in fresh stumps, such as many heart and root rots, will become more prominent. The root-decay fungus *Fomes annosus* will undoubtedly be among the most important. In addition, many foliage and stem-canker diseases will become more damaging, especially where single-species management is practiced.

The Role of Fire

Nearly all of the wild forest stands in Montana were propagated or have been greatly modified by fires. Natural fires have occurred on forested lands on the average of about once every 150 years (Roe and others 1971). The commercially valuable trees and many other plant and animal species now native to the State are those that thrive under periodic fires.

Ecological adaptations to fire found in timber species include: (1) serotiny of lodgepole pine cones--heat of fire opens closed cones and releases seeds; (2) thick, fire-resistant bark that permits trees such as western larch to survive fires long enough to cast their seed on the burned area; and (3) light, wind-disseminated seed of western larch and Engelmann spruce that can blow considerable distances.

The important timber species in Montana most favored by fire are western larch and lodgepole pine. On particular sites (where they are seral), fire also favors ponderosa pine, Douglas-fir, grand fir, and Engelmann spruce. Generally, these species do best when their seedbeds are free from competition and the duff has been burned away to expose a mineral soil seedbed. Controlled fires are used in combination with appropriate harvesting systems to create such conditions.

By and large, even intense fires do little physical or biological damage to the soil itself. For several years following fire, release of nutrients is accelerated, populations of beneficial bacteria and actinomycetes increase, and harmful fungal populations decrease--all changes that benefit timber production. Under severe conditions, burning of the forest floor vegetation may lead to increased, short-term overland water flows and soil erosion.

Generally, fires benefit wildlife. For a number of years after burning, forbs, grasses, and shrubs thrive; food and cover are abundant until the trees once again occupy the site (fig. 17).

Wildfires still have an important role to play in perpetuating the fire-adapted ecosystems now present. To this end, the Forest Service has established a "let-burn" area on the Bitterroot National Forest to gather data on the impacts of fire.

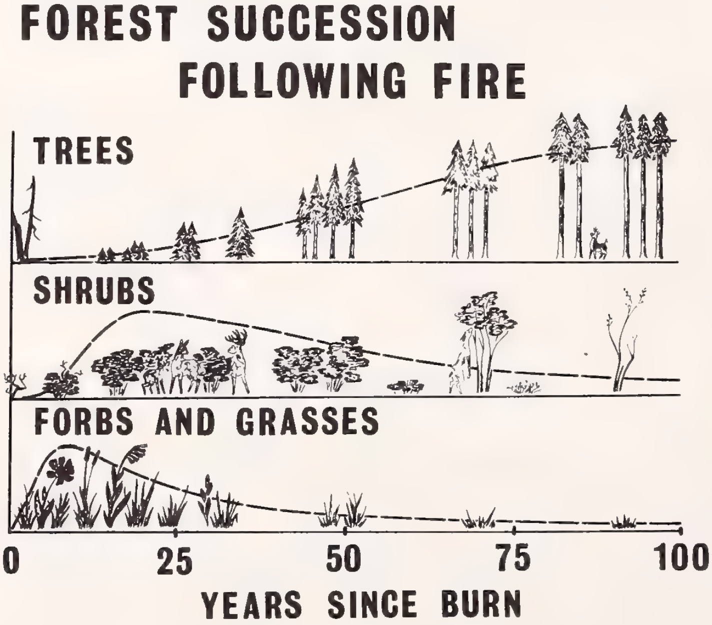

Figure 17.--Forest succession following fire.

Timber Harvest Levels

The modern era of timber harvesting began after World War II when the industry expanded to meet pent-up housing demands. During the past two decades, product makeup has changed. Use of wood for fuel and miscellaneous products has declined, sawlog output has increased, and plywood, pulp and paper, and particleboard have been added to Montana's product mix. Since 1952, the total output of Montana roundwood products (all products except firewood) has more than doubled (fig. 18).

In the past 20 years, the annual removals from growing stock on Montana forests increased from just over 100 million cubic feet to nearly 300 million cubic feet. Sawlogs have been the most important segment of this harvest. During the past 20 years, Montana has gone from a sizable surplus of sawlogs to constant pressures to increase harvesting. From the viewpoint of increasing total timber output, accelerated harvesting has been generally desirable because mortality in old-growth stands is high and the increased harvesting has utilized some of this material before it deteriorated.

Total harvest in Montana has fluctuated from about 1.1 billion board feet to about 1.3 billion board feet in recent years (fig. 19). Most of the fluctuation has been on public lands, primarily on National Forest lands. National Forest harvests have averaged 85 to 90 percent of the total public land harvest, and one-half to two-thirds of the total harvest.

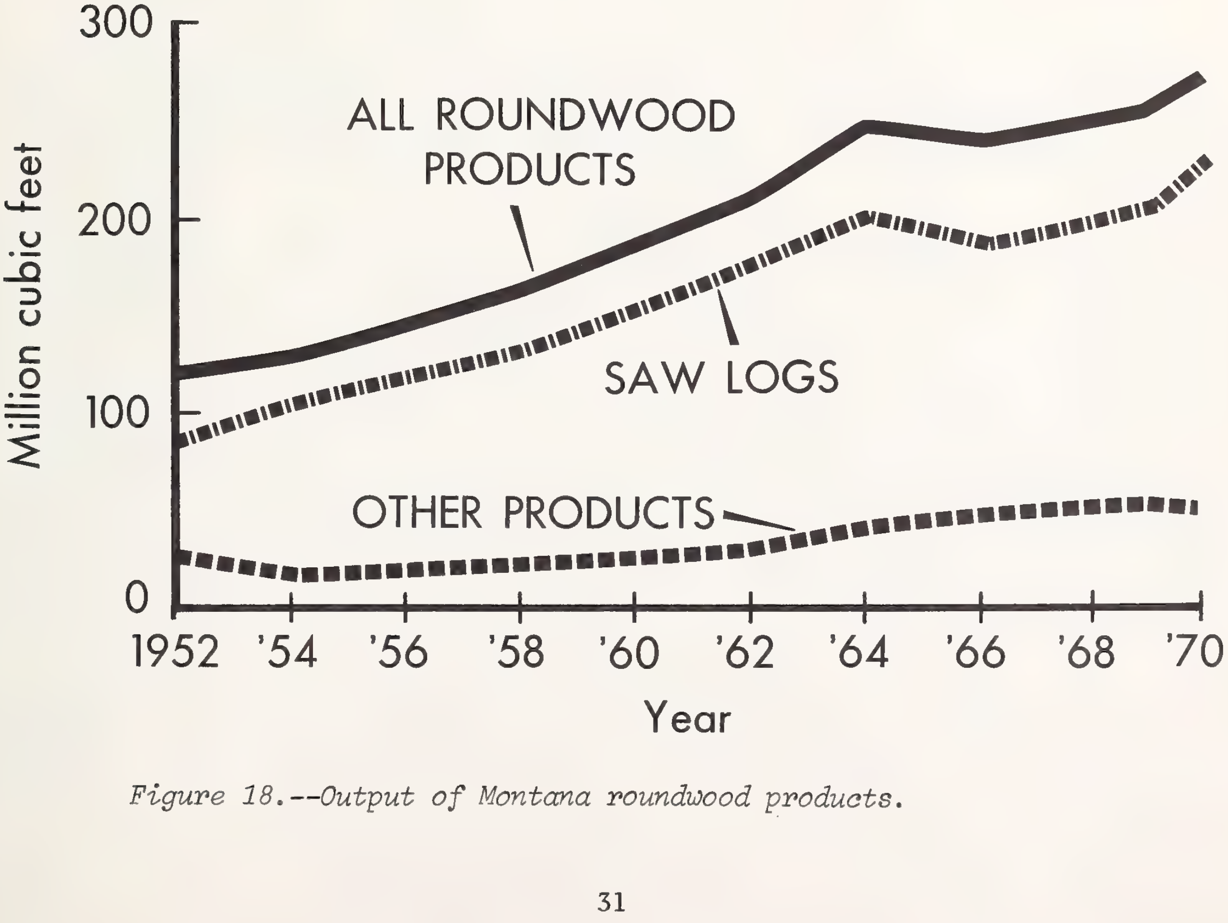

Figure 18.--Output of Montana roundwood products.

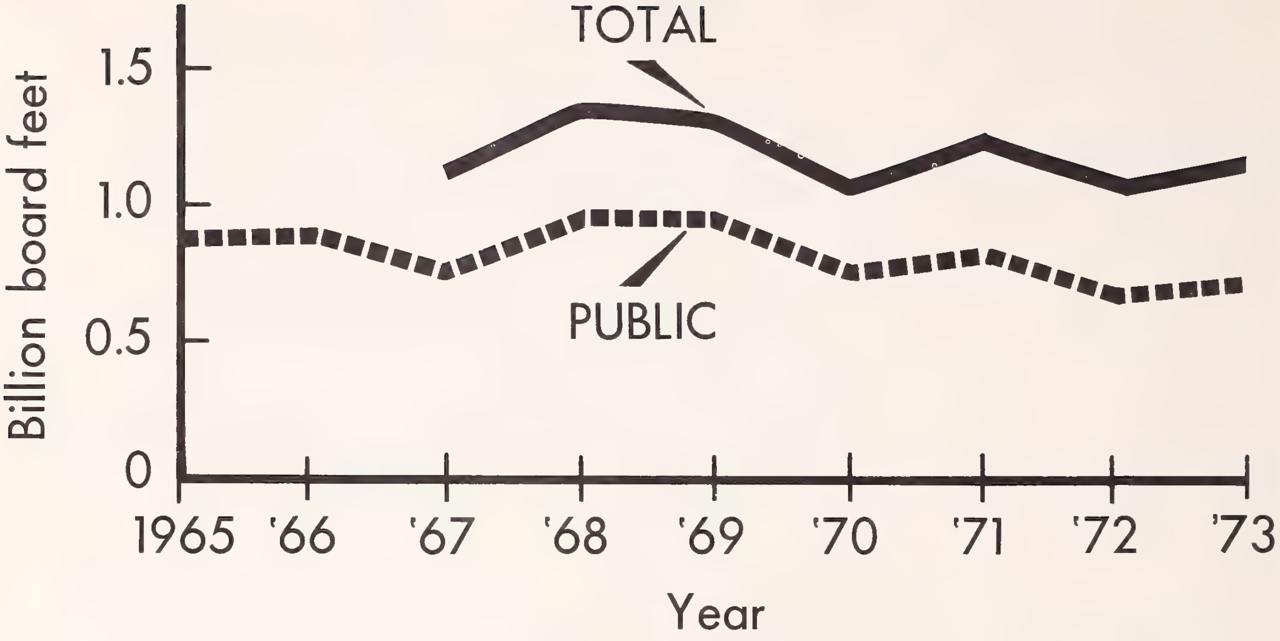

Figure 19.--Total harvest and public timber harvest in Montana.

On private lands, harvest climbed to 402 million board feet in 1971. Large industrial ownerships provide most of the harvest from private land. The year-to-year fluctuations in private harvests caused by changes in market conditions have not changed total harvest levels by very much.

In describing harvesting from Montana's forests, both the actual level of timber harvests and the calculated "allowable harvest" should be considered. The allowable harvest is a long-term planning tool that establishes rates of timber harvesting that will best meet objectives of particular owners. On public lands, one management objective is usually to develop forest stands with high rates of growth. For commercial forest lands stocked with old-growth timber characterized by low growth rates, the rate of cutting suggested by the calculated allowable harvest exceeds the growth of those stands. As more thrifty stands are established, though, forestwide average rates of growth and rates of cutting become nearly equal. The allowable harvest changes over time in response to the revision of timber management plans of individual management units. Recently, the allowable harvest and actual harvest for the four principal forest land managing agencies in the State have been as follows:

Managing agency	*Allowable harvest*	*Actual harvest*
	- - - -(Million bd.	*ft.)- - - -*
Bureau of Land Management		
1969	14	15
1970	14	12
1971	5	5
1972	4	4
1973	2	3
Bureau of Indian Affairs		
1969	90	79
1970	88	56
1971	90	76
1972	75	83
1973	97	98
State		
1969	35	47
1970	35	28
1971	35	22
1972	35	30
1973	35	23
Forest Service		
1969	829	800
1970	996	654
1971	970	739
1972	984	558
1973	969	567

Actual harvests have generally been less than the calculated allowable harvests because of adverse weather, strikes, fluctuations in the marketplace, lack of access, manpower and budget limitations, and so on. In addition, costs and related factors sometimes preclude harvest on marginal areas, even though the timber is theoretically available.

If actual harvests were increased to calculated allowable harvest levels on other than Forest Service lands, less than an additional 20 million board feet would be harvested annually. Major changes in harvest levels on these lands are not likely. Even a substantial increase would have only a small impact on State totals.

National Forest lands hold the principal influence on Montana sawlog harvest. Since 1962, annual allowable harvests have increased from about 750 million board feet to about 900 million board feet, largely because of changes in utilization standards. About 60 percent of this cut is planned for the Kootenai, Flathead, and Lolo National Forests in western Montana.

Actual harvest also increased on National Forests and peaked in 1969 at 800 million board feet--about 95 percent of the allowable harvest (fig. 20). Since that time actual harvest has declined, because of changes in the classification of forest land and because manpower and budgets have not been adequate to cover the special planning, sales administration, and control required. Also, logging contractors have been reluctant to invest in expensive, advanced equipment to harvest lower value timber, particularly because few such systems have been thoroughly tested in Montana.

Montana's sawtimber resource tends toward small-diameter stems--one-third of the sawtimber volume is under 13 inches diameter breast high (d.b.h.). Diameters are smaller than in West Coast States, but larger than in the central and southern Rocky Mountains.

The timber resource is generally found on steep ground, and much of it is overmature with large amounts of cull and dead material. These factors have been a handicap in utilizing the timber resource. However, the capability for logging steep slopes has been improving, and in some localities markets for dead material are rapidly developing. Recent wood shortages and environmental concerns have stimulated research and management activities aimed at using more material formerly wasted.

Increasing the harvest of nonsawlog material will depend on the availability of markets and costs of transportation. Posts, poles, and similar products have historically used only a small portion of the available timber. Even though small stems and defective or dead trees are now being utilized for sawlogs, the amount of material now left behind as nonmerchantable far exceeds immediate demand. If harvest of sawlogs should increase, the availability of residues at mills and in the woods will also increase.

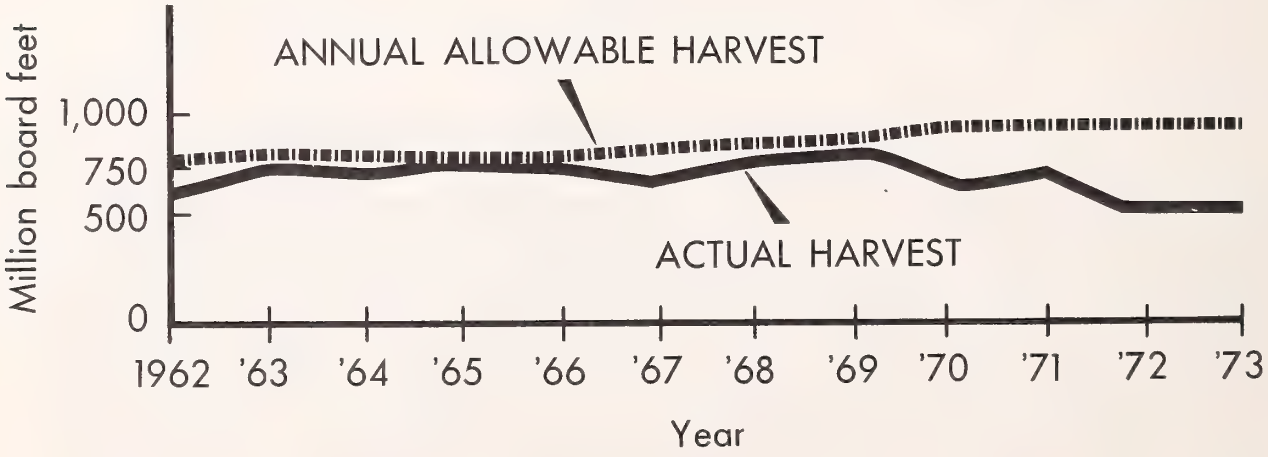

Figure 20.--Actual and allowable harvests of National Forests in Montana.

Future Timber Production

Every projection made to date has suggested that national markets for lumber and other major wood products will increase for at least the next several decades. But the ability of the forests of Montana to share in meeting this increase--or in continuing at present levels of production--hinges on as yet unresolved questions concerning the extent of the land base that will be devoted to timber production and the quantities of products that can be harvested from a given base.

Possible Changes in the Timberland Base

Increases in the National Wilderness Preservation System pose the most dramatic possible reduction in the timberland base. By 1974 the Forest Service had identified more than 1,600,000 acres in Montana as having all the qualifications required of Wildernesses. These acres, designated New Study Areas (USDA Forest Service 1973b), are shown on figure 8. New Study Areas resulted from a lengthy analysis that included extensive public participation. Each area was assigned a Quality Index based on scenic quality and the opportunities for users to achieve both solitude and a variety of experiences. In figure 21

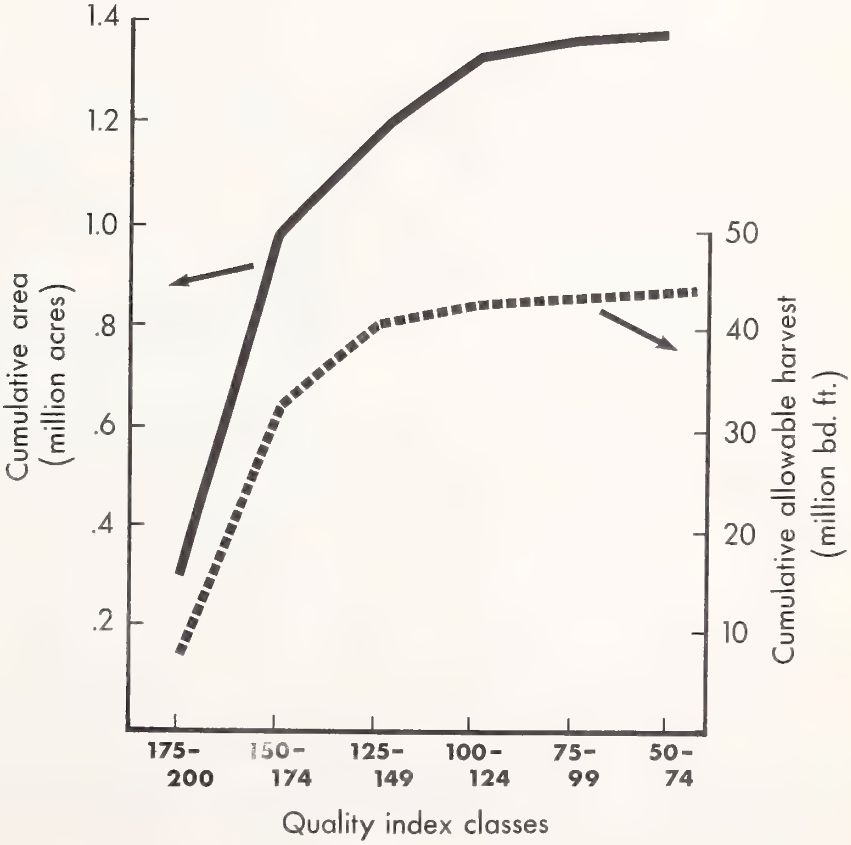

Figure 21.--Cumulative acreages and allowable harvests of New Study Areas by Quality Index classes, Montana.

we have ranked the New Study Areas in Montana by Quality Index (200 = highest possible Quality Index) and plotted the acres and allowable timber harvests involved[3].

Final disposition of the New Study Areas depends upon the completion of detailed management planning. If the top half of the Quality Index-ranked areas were permanently withdrawn from timber production, about 35 million board feet of timber would be lost annually; withdrawing all of these lands would imply giving up the potential harvest of about 45 million board feet annually.

These estimates are only preliminary and will no doubt be adjusted, perhaps substantially, as a result of detailed study. Because productivity of these areas averages only about 31 board feet per acre per year, with a range from 15 to 62 board feet, some of the least productive areas will likely be declared uneconomic to harvest at all.

Because New Study Areas have already been withdrawn from allowable-cut planning they threaten no reduction in current harvesting levels. Instead, the allowable harvests of areas returned to the timber base will be net additions to then-existing harvesting levels.

In contrast to the New Study Areas, removing the remaining roadless areas from the commercial forest land base would reduce the presently calculated allowable harvest levels. Preliminary estimates suggest the direct impacts of such removals would be on the order of hundreds of millions of board feet, a substantial portion of the present allowable harvest.

There would be an additional indirect effect of any massive land withdrawals. Historically, timber harvesting was concentrated where adequate access roads existed. Harvesting was carried out with the expectation that those areas would not again be disturbed for several decades so that wildlife populations and watershed values would not be unduly affected. A nondeclining flow of timber was to be achieved by entering other lands, including those then-unroaded areas that have recently become candidates for permanent withdrawal from timber harvesting. An earlier-than-planned reentering of already harvested lands in some instances has the potential for unacceptable ecological damage.

About a quarter of the allowable harvest is planned for "marginal" and "special" categories of the commercial forest land base. These areas have been identified as needing special consideration for timber harvesting, for economic, esthetic, or ecological reasons. To the extent that satisfactory harvesting techniques can be developed and applied, these lands can supply a larger-than-planned volume of timber.

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[3] The five largest New Study Areas received the highest Quality Index ratings. For a critique of the rating procedures, see Milton (1973). Some Areas on the Gallatin and all Areas on the Custer National Forest were excluded from figure 21 because Quality Indexes had not been developed (all excluded areas are small).

Possible Changes in Timber Management

For the most part, the Forest Service is still managing an old-growth resource in Montana. But in areas where timber has been or will be harvested, the production of wood products can be increased through intensive management.

In general, wood production can be increased by speeding up regeneration, by minimizing the time between regeneration and harvesting, by reducing losses of growing stock to natural mortality, insects, diseases, and fire, and by improving the utilization of the timber that is harvested. A necessary precondition to these opportunities is the development of an adequate road system.

In 1972, about 3.25 million acres of National Forest lands needed either regeneration or stocking control in the Northern Region, which includes northern Idaho (fig. 22). The most pressing need was stocking control in stands that had not previously been harvested. This included about 300,000 acres in Montana where 1,000 to 3,000 board feet per acre could be thinned; some of the thinnings would likely be marketable. About 60,000 acres of National Forest lands in the State, excluding high elevation zones, were nonstocked.

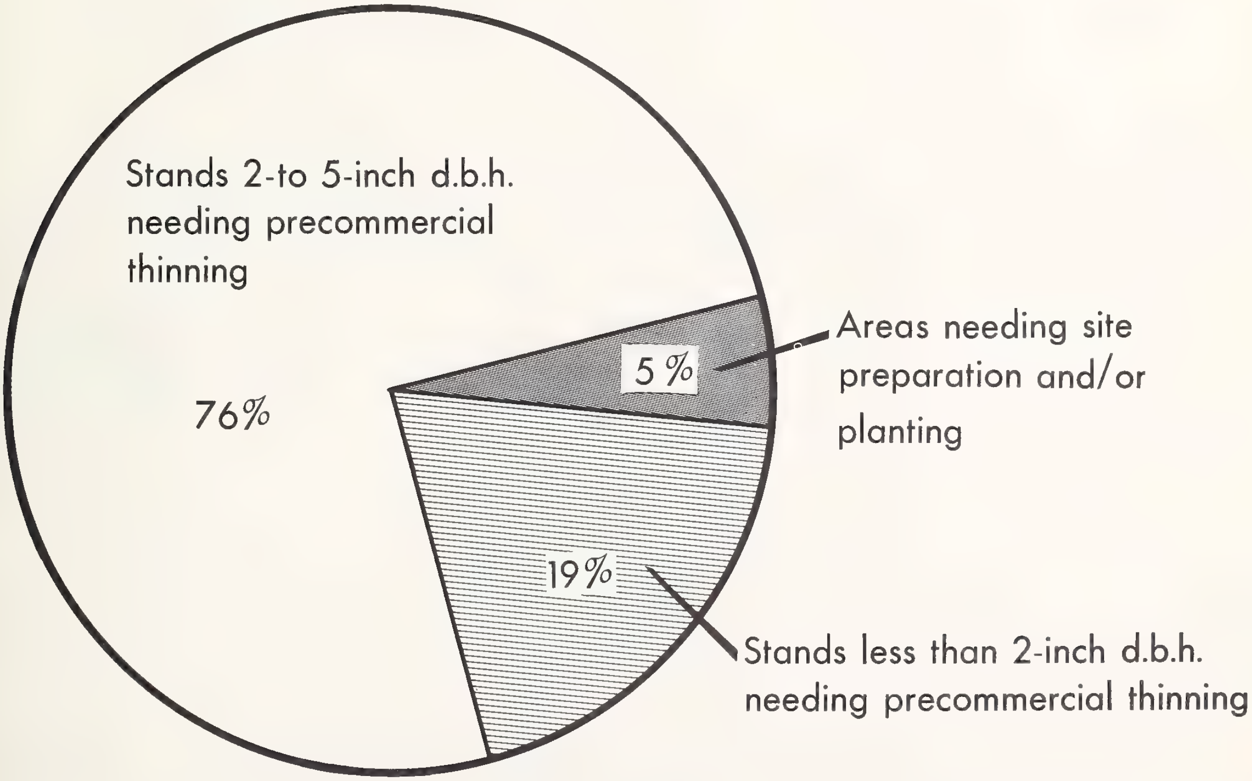

Figure 22.--Areas needing regeneration and precommercial thinning in the Northern Region, 1972.

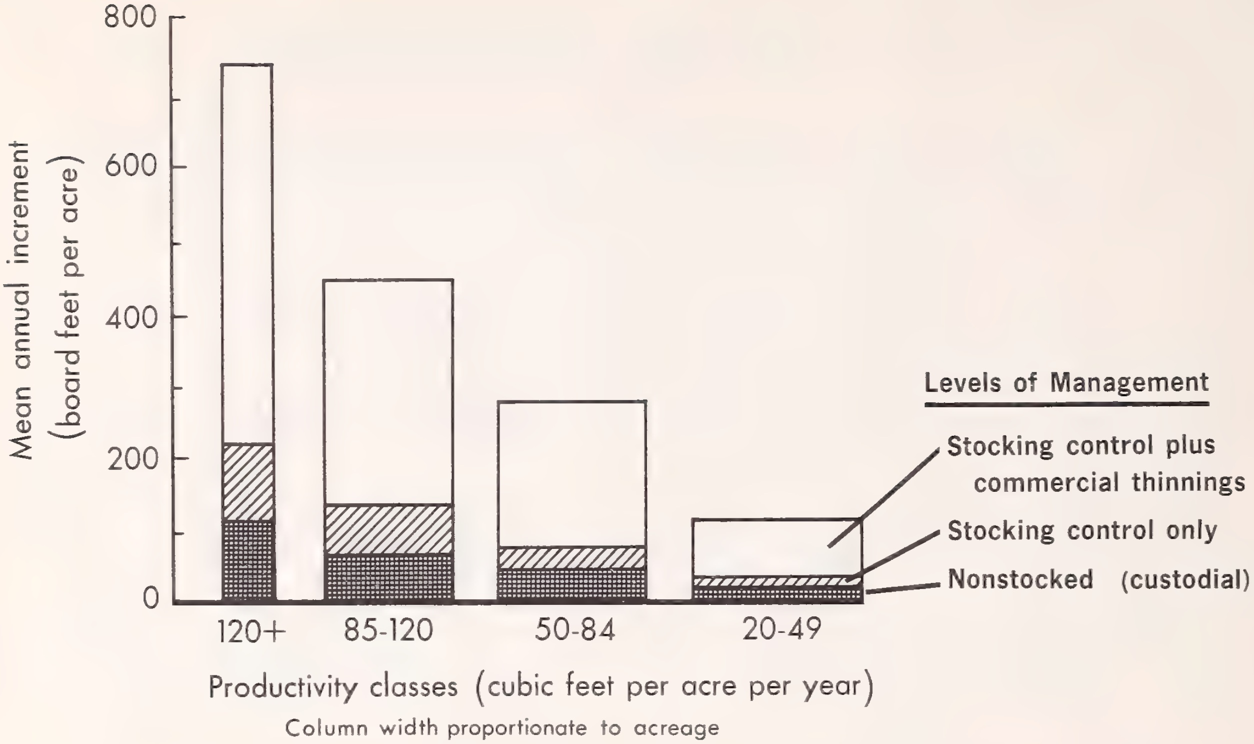

Figure 23.--Achievable mean annual increments under alternative management regimes by productivity classes (Northern Region Office data, 1972).

The potential gains in growth from regeneration and thinning are shown in figure 23. Adequate stocking controls alone would, on the average, double growth over that in wild stands. If, in addition, three commercial thinnings were carried out on the best sites, merchantable wood production could be tripled. Two commercial thinnings on the medium sites and one thinning on the poorest sites also promise substantial increases.

Tree improvement through the planting of genetically superior stock also will lead to increased growth rates and the production of a superior product. Trees being planted now are expected to increase timber yields by about 15 percent in 30 or 40 years (Howe 1973).

Net growth in Montana's old-growth timber varies from 60 to about 150 board feet per acre per year. Forestwide, annual yields under intensive management are expected to exceed 400 board feet per acre on the Flathead, Kootenai, and Lolo National Forests and to exceed 200 board feet on other Forests. The ability to replace the old growth with second-growth forests, and to achieve the higher growth rates, is dependent upon rates of road development and operating budget levels.

These items are also critical when we consider the assumptions basic to allowable harvest calculations. For the National Forests in Montana, present planning assumes that all stands undergoing regeneration harvests will then have stocking control and commercial thinning (fig. 23). As a result, the

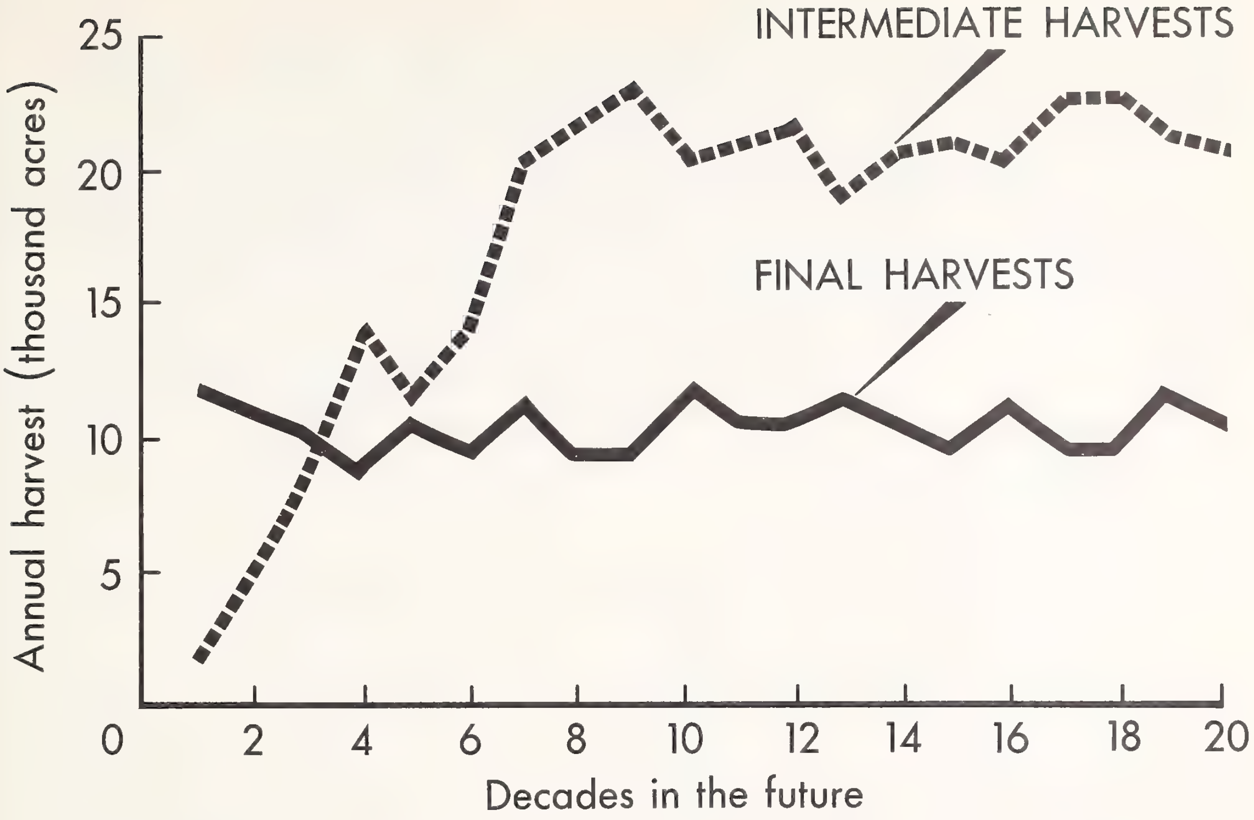

Figure 24.--Preliminary estimate of harvesting program for the Flathead National Forest (excluding overstory removals).

allowable harvest will steadily increase for 60 to 80 years and then stabilize. This is illustrated for the Flathead National Forest in figure 24. Acreages were generated by the Forest Service's computerized Resource Allocation Model (RAM), which most National Forests in Montana are now using in long-range planning. Within 70 years, it is expected that twice as many acres will be commercially thinned as will be undergoing final harvests. Although much higher total yields are likely, such a program will also be more expensive to administer. On the average, thinning will produce between one-third and one-half as much wood per acre as final harvests; the sale preparation and administration costs per unit volume will be substantially higher.

The historical trend has been toward utilizing more and more of the available wood. Diameter limits for harvest have gone from 13 inches d.b.h. or more, to currently 8 inches or even 7 inches. Top-diameter limits have gone from 8 inches or more to 2-1/2 inches in some species. In the early days, trees were often cut selectively. This took only a few of the choicest trees and left everything else growing, so direct "loss" cannot be estimated with confidence. When clearcutting became widespread practice, often 50 percent or more of the original fiber volume was left on the ground. Several recent studies indicate that virtually all (97 percent) of the available wood, live or dead, could be recovered for fiber use (Gardner and Hann 1972). Soon, up to 25 percent more wood might be recovered for sawlog or other solid wood use under utilization standards now being developed. This, of course, is highly variable, depending on species and proportions of dead, rotten, or other cull trees.

These are not all the changes that could affect allowable harvest levels, but they are the ones most likely to occur in the near future. Rough estimates of the maximum impacts on harvest levels for each of these changes are summarized below; note that these impacts are not additive:

	Change in annual allowable harvest *(Percent)*
All roadless areas removed from commercial forest land base	-35
Marginal areas do not become available for harvest	-15
More time required to replace old growth with second-growth stands	-15
Less time required to replace old growth with second-growth stands	20
Intensive management (reforestation and thinning)	20 to 30
Tree improvement (harvest increase in 30 to 40 years)	15
Utilization improvement	25

CHAPTER III

PRODUCTION OF WOOD PRODUCTS

During the past decade, Montana has provided between 3-1/2 and 4 percent of the total softwood lumber consumed in the United States. The bulk of the 246 million cubic feet of wood harvested in Montana in 1969 was in the form of sawlogs and veneer logs. Total harvests were about the same as 5 years earlier, but nearly double those of the late 1950's. Harvested wood was in the forms listed below (Setzer 1971):

Timberland products (1969)	*Share of output* (*Percent*)
Sawlogs	85.9
Veneer logs	11.6
Pulpwood	.7
Mine timbers	.6
Poles	.3
Other	.9
	100.0

About one-fourth of the veneer and sawlogs used in Montana were Douglas-fir (fig. 25); ponderosa pine and western larch were other principal species. Mine

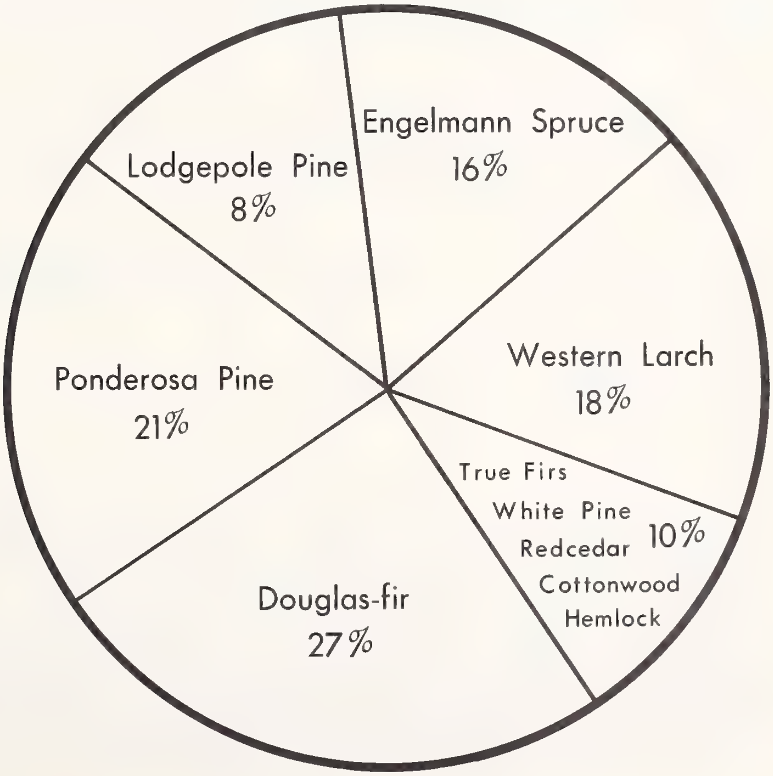

Figure 25.--Proportions of log volumes received by Montana mills by species, 1969.

timbers were manufactured primarily from Douglas-fir and western larch. Lodgepole pine was used in most of the other minor forest products.

Logs came principally from six counties (Setzer 1971):

County	*Share of logs* (*Percent*)	*Principal species by volume*
Lincoln	39	Western larch, Douglas-fir, ponderosa pine
Flathead	17	Engelmann spruce, Douglas-fir
Missoula	9	Ponderosa pine, Douglas-fir
Lake	6	Western larch, Douglas-fir
Ravalli	6	Douglas-fir, ponderosa pine
Sanders	5	Ponderosa pine, Douglas-fir
Others	18	Ponderosa pine, Douglas-fir
	100	

The important role of Douglas-fir in Montana is emphasized by its appearance as one of the two principal species for each of the leading log-producing counties. Only a small percentage of logs came from out of State.

Plywood mills in Montana--the first ones were built in the 1950's--currently supply about 3 percent of U.S. softwood plywood. Output of other products--poles, posts, etc.--is relatively minor in Montana and accounts for about 2 percent of the total U.S. consumption.

In the last few years, private timberlands have provided an increased share of Montana's log production:

Ownership	*Percent of total log production*						
	1965	*1966*	*1969*	*1970*	*1971*	*1972*	*1973*
National Forests	58	59	61	60	59	51	51
Other Public	6	9	11	9	8	11	11
Private	36	32	28	31	33	38	38

In fiscal year 1971, about 660.5 million board feet of logs were received at Montana mills from National Forests within the State. The origins and destinations of these logs are summarized in table 1 for the 12 forests involved. (Note that the county log receipts in the table do not include logs from private lands or from public lands other than National Forest.) Perhaps an additional 40 million board feet were imported from the Clearwater and St. Joe National Forests in Idaho (primarily to Superior and Missoula), and about 20 million board feet were exported from the State.

Table 1.--*Flows of logs from Montana National Forests to Montana Counties, 1971*

Receiving county	National Forest of origin												
	Beaverhead	Bitterroot	Clearwater	Custer	Deerlodge	Flathead	Gallatin	Helena	Kaniksu	Kootenai	Lewis & Clark	Lolo	TOTAL
	Million board feet												
Beaverhead	2.1				0.1								2.2
Broadwater					1.1			2.8					3.9
Carbon				0.3									.3
Deerlodge					.5								.5
Fergus											0.1		.1
Flathead						132.2				26.3		9.3	167.8
Gallatin							16.4						16.4
Granite					10.6								10.6
Jefferson					.7								.7
Lake						13.7						9.8	23.5
Lewis & Clark								2.8					2.8
Lincoln						2.4			10.8	163.4			176.6
Madison					.2								.2
Meagher								1.2			14.7		15.9
Mineral			0.1									10.0	10.1
Missoula		6.0	8.0		9.7	.8		3.4				71.3	99.2
Musselshell											.5		.5
Park							6.8						6.8
Powell	4.8				13.2			1.4					19.4
Ravalli	9.1	40.1			.6								49.8
Rosebud				.1									.1
Sanders									25.9			24.3	50.2
Silver Bow					2.5								2.5
Sweet Grass							.4						.4
Subtotal Montana	16.0	46.1	8.1	.4	39.2	149.1	23.6	11.6	36.7	189.7	15.3	124.7	660.5
Outside Montana			116.1	.9					121.4	16.0		19.7	274.1
Total	16.0	46.1	124.2	1.3	39.2	149.1	23.6	11.6	158.1	205.7	15.3	144.4	934.6

Montana's Wood Products Industry

The wood processing plants in Montana, listed by products, are:

Product	*Number of processing plants*		*Total 1973 production*	*Comments*
	1966	*1973*		
Lumber	148	100-125 est.	1,350 MM bd. ft. est.	Average size increasing
Plywood and veneer	6	5	460 MM ft^2	The State's largest mill at Bonner was not yet in production. One mill operated just 3 months in 1973.
Particleboard	0	1	100 MM ft^2	1 fiberboard/ particleboard mill at Columbia Falls was under construction. Third mill proposed at Bonner to nearly double output.
Paper and pulp	1	1	1,150 tons/day	65% increase in output proposed.
Posts, poles, piling, houselogs	30 est.	30 est.	Unknown	Now four pressure-treating facilities in State.
Christmas trees	Unknown	Unknown	2 MM trees est.	Declined since late 1950's.

Lumber Production

As in most of the United States, there has been a long-term reduction in the number of small sawmills in Montana. Between 1956 and 1966, the number of mills producing less than 10 million board feet per year had declined from 307 to 111. At the same time, the number of mills producing more than 10 million board feet increased from 26 to 37, and their average annual production went up from 25 to 35 million board feet. By 1966, lumber production was split among mills as follows (Setzer and Wilson 1970):

	Total	*Annual mill production (1966)*		
		More than 10 MM bd.ft.	*1-10 MM bd.ft.*	*Less than 1 MM bd.ft.*
Number	148	37	25	86
Production (MM bd.ft.)	1,375	1,238	80	57
Share of total production (Percent)	100	90	6	4

Although there has been no recent survey, we estimate that the number of smaller mills declined substantially. This judgment is supported by the changes in numbers of sawmills and planing mills illustrated in figure 26 (developed from annual reports of the Census of Manufacturers). While the total number of mills has been declining at an average rate of six or seven per year for 15 years, the number of larger mills has remained nearly constant. For 1973 we identified 22 individual mills that each produced between 10 and 50 million board feet annually and another seven mills that each produced more than 50 million board feet.

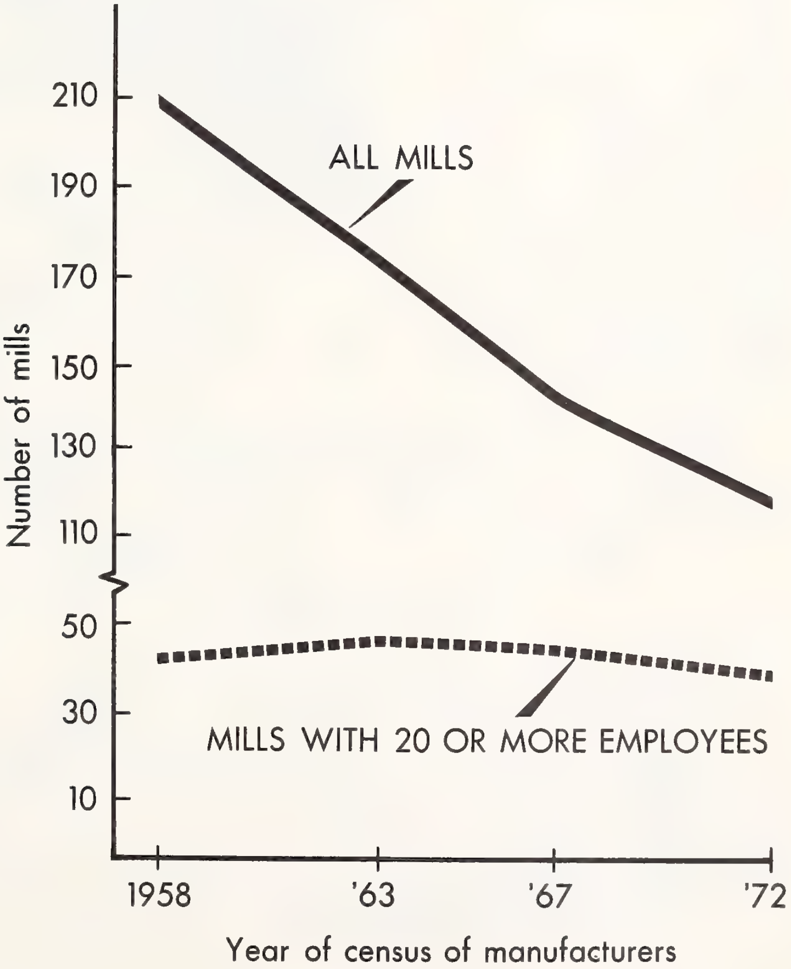

Figure 26.--Numbers of sawmills and planing mills in Montana, 1958-1972 (SIC 242).

Perhaps the most striking characteristic of the sawmill industry is its pattern of ownership. Nearly all of the mills producing more than 10 million board feet annually are owned by multi-State corporations headquartered outside of Montana. In figure 27, the shares of Montana's 1973 lumber output are identified for all corporations owning mills that in the aggregate produced more than 50 million board feet within the State (Forest Industries 1974b). Those corporations alone produce more than three-fourths of the State's total lumber.

Major lumber producers are important nationally as well as within Montana. Louisiana-Pacific, currently the nation's leading lumber producer, in 1973 acquired several wood products firms in Montana. In the aggregate, Montana lands contribute about one-fourth of the total United States production of these corporate giants (table 2).

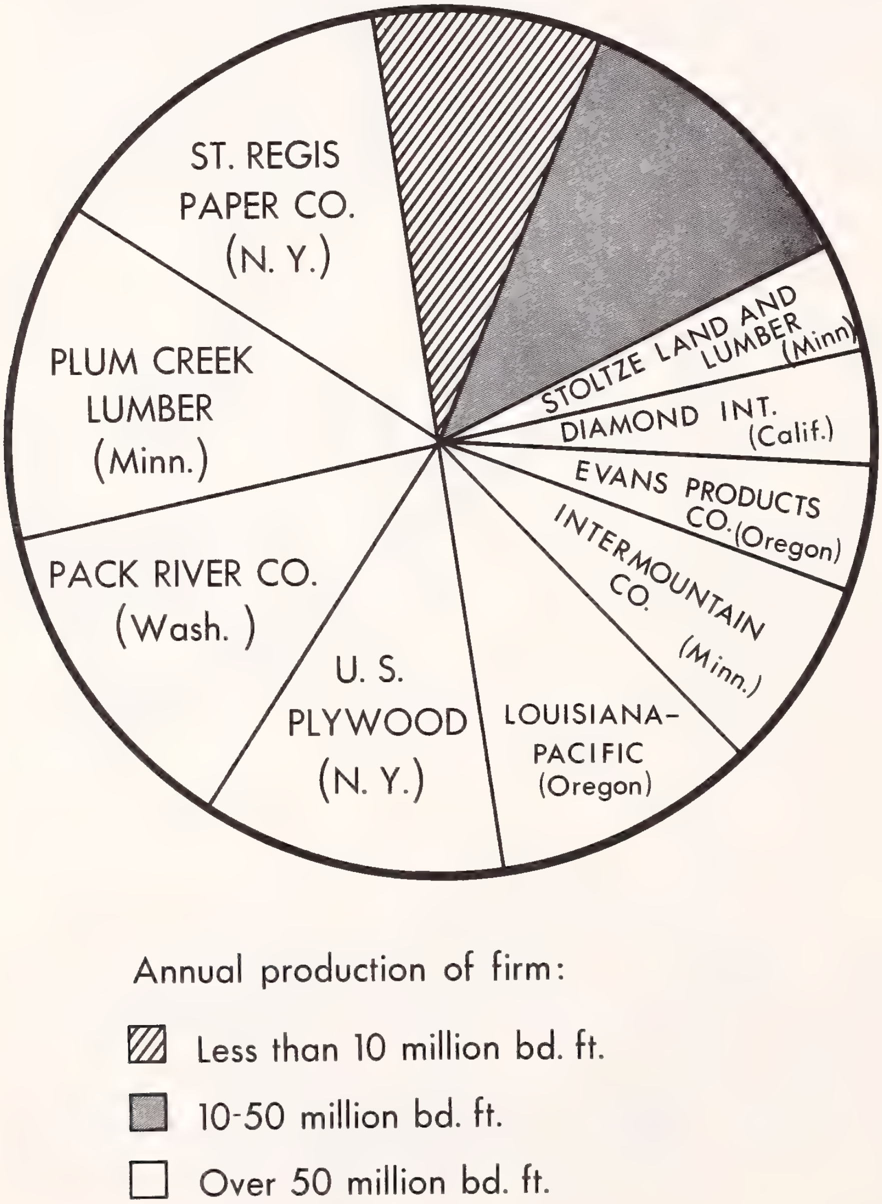

Figure 27.--Montana 1973 lumber production by major firms and locations of corporate headquarters.

Table 2.--*Selected characteristics of firms producing more than 50 million board feet of lumber in Montana in 1973*

Firm (and corporate owner, if different)	Montana lumber production	No. Montana mills	Montana production as percent of firm's total U.S. lumber production	Production ranking among U.S. lumber firms
	MM bd.ft.		*Percent*	
St. Regis Paper Co.	196	2	52	11
Plum Creek Lumber (Burlington Northern)	195	4	100	24
Pack River Co.	174	4	29	6
U.S. Plywood (Champion International)	171	3	26	5
Louisiana-Pacific Corp.	135	4	6	2
Intermountain Co. (Hoerner Waldorf)	112	2	84	32
Evans Products Co.	63	2	100	79
Diamond Int'l.	61	1	17	14
Stoltze Land & Lumber	53	2	100	95
	1,160	24	25	

The sawmills are not scattered throughout Montana, but are concentrated mostly on the timber-rich lands west of the Continental Divide. In 1973, four communities produced more than 100 million board feet, five exceeded 50 million board feet, and 19 produced between 10 and 50 million board feet (fig. 28).

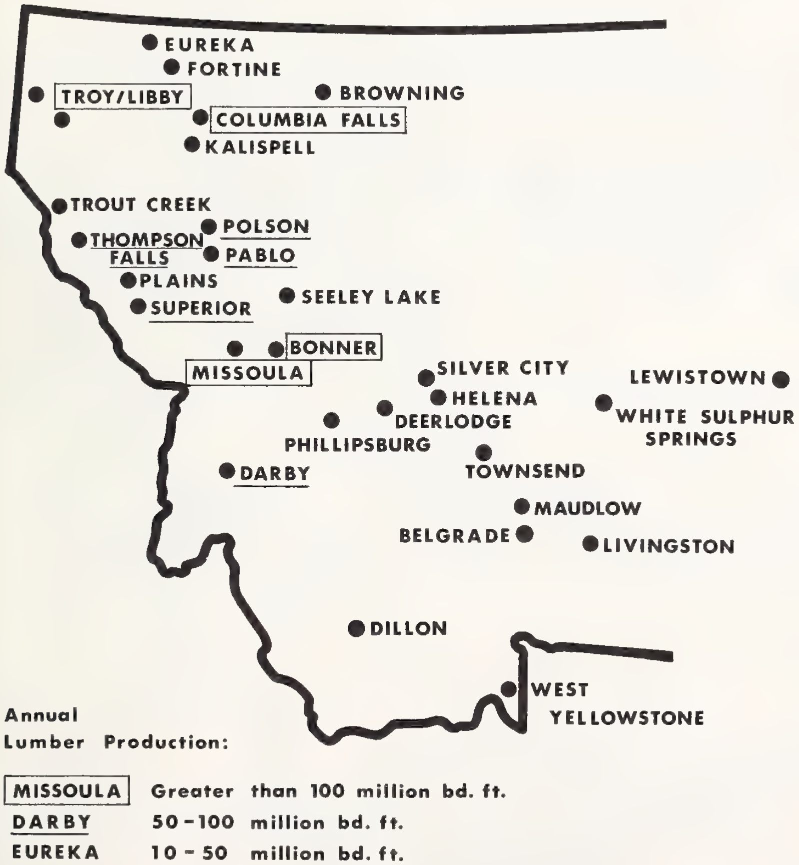

Figure 28.--Principal lumber production centers in Montana, 1973.

U.S. Plywood has just completed enlarging its mill at Bonner, making that community a major production center. Other mills currently being enlarged or under construction are located at White Sulphur Springs and Roundup.

Increased production has led to more mill residues. Tough new standards limiting air pollution have exerted pressures on industry to use, not burn, these materials. A strong demand for wood chips in Missoula and outside the State has provided markets. Concentrating production in larger mills has permitted the economies of large-scale operations necessary to economically process and transport wood chips. Mill residues consist of slabs and edgings, which are generally converted to chips; of planer shavings and sawdust, used for fuel and particleboard; and of bark, which can be used for fuel. On balance, smaller volumes of these residues are wasted now than a few years ago (Setzer 1971):

Year	*Residues*	*MM Ft*^{3}		*Used*	
				Percent	
1969	Coarse	61	118	87	74
	Fine	57		60	
	Bark		38		28
1966	Coarse		73		66
	Fine				

Plywood and Veneer Production

Four mills presently produce softwood plywood and veneer in Montana (Fig. 29); the mill at Polson closed early in 1973 and a small plywood plant at Whitefish burned down in 1970. The plants are all located in western Montana from Kalispell south to Missoula. As in the case of lumber production, the bulk of plywood production is controlled by firms with interests outside Montana (Forest Industries 1974a).

The locations of plywood production and other nonlumber wood products plants are shown in figure 30.

U.S. Plywood's mill, reported to be the world's largest plywood mill under a single roof, has begun production at Bonner. This new mill is expected to increase statewide plywood output by two-thirds, to 750 million square feet annually, and will supply about a quarter of that firm's national plywood production.

Particleboard Production

In 1973, Evans Products of Missoula was the only particleboard plant in Montana. It produced about 100 million square feet (on a 3/4-inch basis).

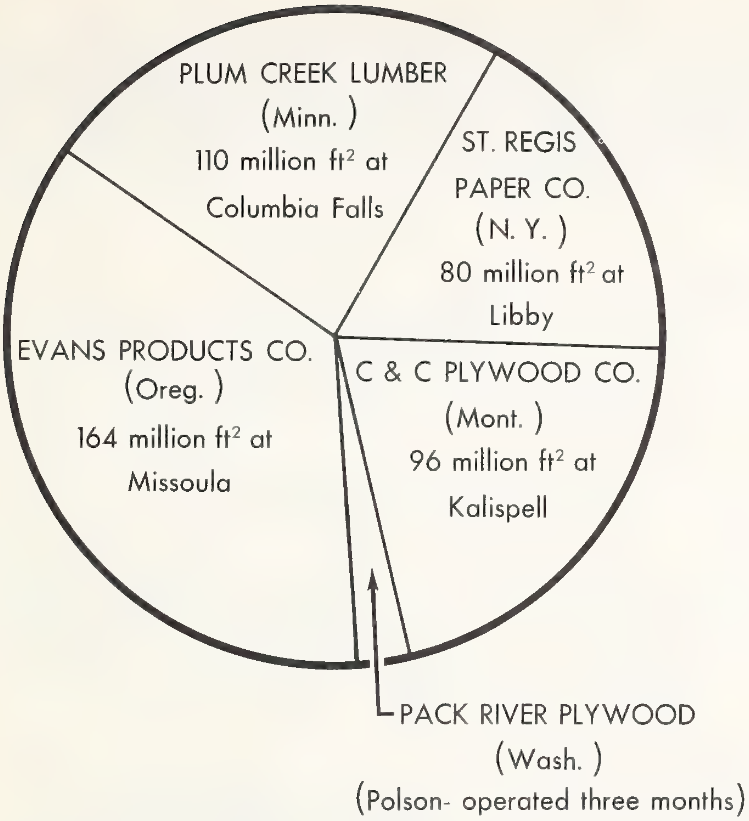

Figure 29.--Montana 1973 plywood production (square feet, 3/8-inch basis) by firms and locations of corporate headquarters.

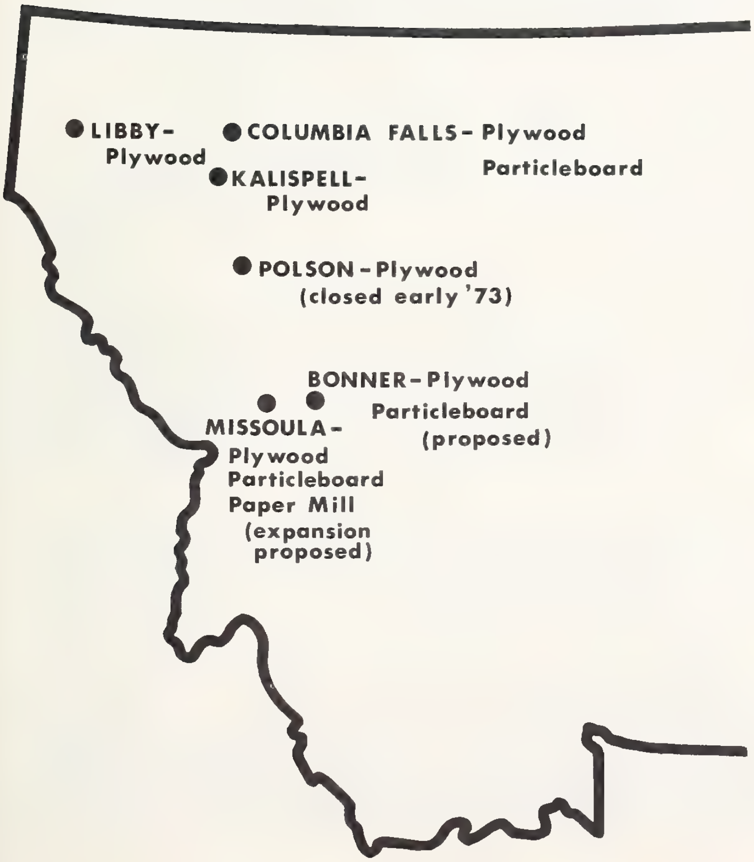

Figure 30.--Production centers for plywood, particleboard, and paper in Montana, 1974, and prospective additions.

A Plum Creek Lumber Co. plant now in production at Columbia Falls will concentrate on fiberboard, but it will also be able to produce particleboard. Its annual production is expected to be about 70 million square feet. A major additional particleboard plant, that might double the State's total current production, has been reported to be under consideration by U.S. Plywood at Bonner.

Paper Production

Hoerner Waldorf's mill in Missoula is the only papermill in the State. Current daily production is about 1,000 tons of linerboard and 150 tons of bleached pulp. Recently announced expansion plans would increase output to a combined total of 1,850 tons per day of kraft pulp, paper, and linerboard. It has been announced that the total annual wood use for the expanded plant would be about 3 million cubic feet of roundwood and 121 million cubic feet of mill residues.

During periods when sawmill production has been restricted, as in 1969 and 1974, Hoerner Waldorf has relied more heavily on roundwood--dead material that has not been part of the growing stock of the forest. Recently, competition for chips (and even for dead roundwood) from west coast mills has increased the firm's reliance on roundwood.

To convert roundwood to chips, by the end of 1974 Hoerner Waldorf had established permanent chipping installations at Missoula, Columbia falls, and Dillon. In addition, three portable chippers were being moved between wood concentration points near Darby, White Sulphur Springs, Belgrade, Livingston, and other lumber production centers.

Future Increases in Mill Capacity

In spite of the 1974 slump in lumber production, wood products manufacturers are generally bullish on Montana. Announced plans for the expansion of production for all the major wood products are:

Product	*Additional capacity*
Lumber	100 million board feet annually
Plywood and veneer	300 million square feet annually
Particleboard	100 million square feet annually
Paper and pulp	700-750 tons per day

If these plans are realized, some increases may simply offset losses of mills leaving the market. The trend toward multi-State corporate ownership and the high capital investments made in recent years suggest that only the least productive mills will be lost.

Other Products

Only limited data are available on miscellaneous roundwood products and Christmas trees. Total volume of wood used and total employment are a small part of State totals, but can be important locally. Output of transmission poles has declined in the past two decades due to market conditions and to the economies of production. However, posts, corral poles, house logs, and similar items have developed strong markets in interstate highway fencing, ranchette development, and rustic decorations. Volume of these products is approximately:

	Million cubic feet
Pulpwood (round)	1.6
Transmission poles	.8
Mine timbers	1.8
Posts, corral poles, etc.	1.3
Miscellaneous	.6

Christmas tree shipments declined from a peak of 4 million in 1956 to about 2 million in 1964. Current output is estimated at about 2 million trees per year. This long-term decline has been caused by a growing market preference for plantation-grown trees and artificial trees and partly by insect damage to wild trees.

Marketing of Wood Products

Species and Sizes

Although Montana makes an important contribution to the national supply of forest products, it does not claim any unique products or tree species. Its contribution is mainly commodity wood products. One species, western larch, is primarily found in western Montana and north Idaho. In a few instances larch lumber, sold as "Montana cypress," brings a premium price in select grades. However, this use is of relatively minor importance, and for the most part Douglas-fir and western larch are sold as "fir-larch" lumber. Prices for this mix are generally slightly lower than the price of west coast Douglas-fir lumber.

The only other species that might be considered unique is lodgepole pine--because it comprises such a large portion of the total timber inventory. Lodgepole is generally of small diameter and, because of processing costs and early resistance in the market, has only recently established itself as a major lumber species. Today, the market neither discriminates against nor favors lodgepole lumber.

Lodgepole is well suited for pulpwood and small roundwood products such as posts, poles, and house logs. However, the markets for these are so weak that lodgepole is not being fully utilized presently (Benson 1973).

In general, Montana's forests offer mixed species such as Douglas-fir/larch, Douglas-fir/ponderosa pine, and spruce/true firs. Mixed species are considered to be more resistant to some insect and disease pests than pure stands. Lodgepole pine is an exception because it usually grows in relatively pure and even-aged stands. Overmature stands are subject to insect and disease attacks that result in large-scale mortality.

Potential for Utilizing More of the Wood Resource

Early timber harvests in Montana took only the largest, best quality, and most accessible trees. Harvesting practices and utilization standards gradually changed. Sizes and species are now being utilized that 10 years ago or less would have been left in the woods. For example, National Forest timber sales consider trees of 7-inch d.b.h. sawtimber. Any piece that could yield 10 board feet must be removed from the sale area. Some manufacturers with specialized equipment are taking logs as small as 3-inch and 4-inch top diameter to be sawed into lumber. Despite improvements in utilization, a considerable amount of additional wood could be utilized. Logging slash--tops, small trees, defective trees, broken chunks, etc.--can range from less than 50 to more than 100 tons per acre.

One of the principal obstacles to greater utilization of wastes is the lack of local markets for wood fiber. The papermill and particleboard plants operate primarily on residues generated at lumber and plywood plants, material that "rode free" on sawlogs from the woods. Hauling roundwood from the woods specifically for these products would be comparatively expensive. It has been estimated that two additional particleboard plants could operate on the available fine residues (Withycombe, in press). The pulpmill, however, has occasionally used round pulpwood to supplement mill residues and most of the proposed expansion would be based on roundwood.

In the Bitterroot Valley, a local Resource Conservation and Development group is currently exploring the feasibility of harvesting timber using a low investment operation such as horse logging or small tractors. The objective is twofold: to supplement income of local residents who might devote several weeks or months per year to logging with equipment they have on hand; and to utilize a resource such as small size, low-volume lodgepole stands that wouldn't justify full-scale logging (Bjergo 1972).

Geographic Location

For years the harvest of timber in Montana was only a fraction of its potential, mainly because of the State's isolation--Montana is a long way from the principal wood products markets--and because forest access roads were lacking.

As market demands increased, particularly in the last two decades, prices for wood products rose. As access roads were developed, the timber harvest approached the allowable harvest established for sawlogs. Even though the distance to eastern markets hasn't changed, the development of a strong industry, establishment of competitive freight rates, and viable marketing practices have largely diminished any locational disadvantages. Nowadays most Montana producers participate in national markets, either through their internal, nationally-oriented marketing organizations or through wholesalers (Adair 1966).

Strong demand for pulpwood has improved the outlook for marketing material not suitable for sawlogs. Some roundwood pulpwood is now being shipped from eastern and central Montana to Lake States papermills. Also, some pulp chips are now shipped to west coast mills, and there are strong indications that this market will grow.

Nevertheless, local increases in particleboard production and similar fiber products will largely depend on available mill residues rather than large-scale use of logging residues or roundwood. Several areas in the Northern Rocky Mountains have concentrations of unused mill wastes, including the Kootenai Valley around Libby. The Flathead area and lower Clark Fork also have substantial quantities of unused residues at scattered mills, but long hauls to a central plant would be required to utilize them (Withycombe, in press).

Industry Investments and Productivity

Expenditures to replace or expand existing capital assets have been increasing statewide for at least a decade, growing from $39 million in 1963 to $75 million in 1972. For much of that time, the lumber and wood products firms have been leading the way as suggested in the following tabulation:

	New capital expenditures		
	1963	*1967*	*1972*
	(Millions of dollars)		
Logging	3.0	0.0	2.2
Sawmills, planing mills	6.0	3.2	6.0
Veneer, plywood, and particleboard	.7	1.4	5.3
All lumber and wood products	9.8	6.2	15.9
	(Percent)		
All lumber and wood products as a proportion of all industries	25	9	21

Because the wood products industries are labor intensive, the most widely used index of industrial productivity, value-added-per-employee, is low relative to other manufacturing industries in Montana. Considering heavy capital investments recently made in wood products, value added would be expected to increase. In comparison with value-added-per-employee achieved by similar industry in the Rocky Mountain region and in the United States as a whole, however, Montana's wood products industry dropped from first to last place between 1956 and 1971 (fig. 31). Until 1971, at least, Montana's industry had not kept pace in spite of substantial capital investments. We suspect that in the late 1950's--the onset of declining productivity--that harvesting had exhausted much of the prime, lowland timber and began to move into less profitable stands at higher elevations.

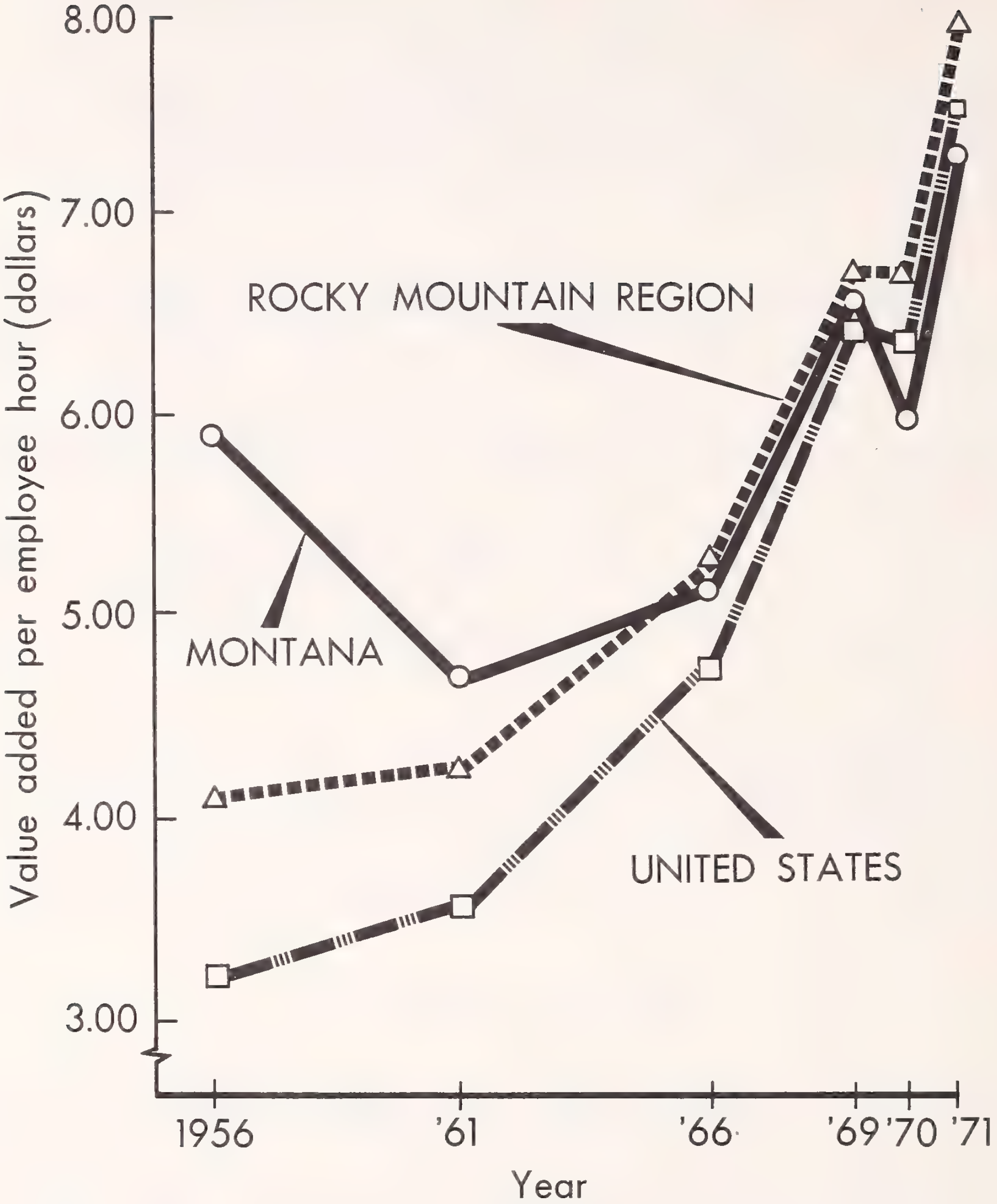

Figure 31.--Value added per production employee hour for the lumber and wood products industry.

CHAPTER IV

PRINCIPAL NONTIMBER USES OF THE FOREST

The preceding section on the timber-based industries has been developed in detail because of their economic importance and because data are available. However measured, much less is known about the other forest resources and their importance. This chapter describes the more important aspects of recreational use of forested lands, and then briefly discusses grazing and mining.

Recreational Use

In 1969, out-of-State tourists in Montana, excluding transportation, were estimated to support a $145.5 million industry (Mussehl and Howell 1971). A substantial share of these dollars were, no doubt, spent by visitors traveling to forested parts of the State. Other dollars were spent for second homes, recreation sites, and activities that depend upon nearby forests to provide desirable settings.

Twelve Montana counties increased in population by more than 10 percent between 1960 and 1970 (fig. 32). Most of these counties lie in forested western

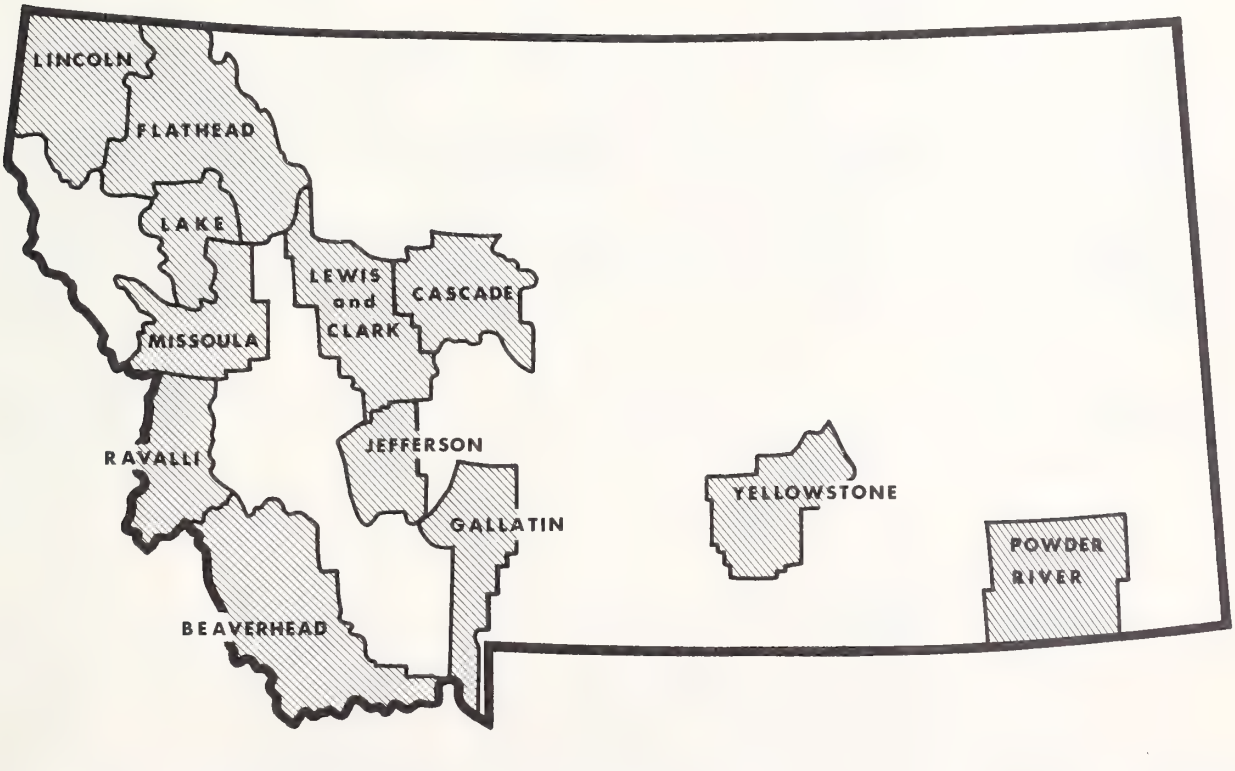

Figure 32.--Counties increasing in population by more than 10 percent, 1960-1970.

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Table 3.--*Characteristics of counties with population growth of more than 10 percent, 1960-1970 (Gustafson 1973)*

County	Major public expenditures	Indian Reservation population growth	High amenity values	Other factors
Beaverhead	Education		X	
Cascade	Military			Trade center
Flathead		X	X	Wood products industry
Gallatin	Education		X	
Jefferson			X	
Lake		X	X	
Lewis & Clark	State government			
Lincoln			X	Dam, railroad construction
Missoula	Education	X	X	Wood products industry
Powder River				Oil development
Ravalli			X	Residential development
Yellowstone	Education	X		Trade center

Montana. Two-thirds of these counties have been rated as high in amenity values (Gustafson 1973) in terms of forest, waters, and topography (table 3). Although population growth reflects employment opportunities in these areas, there is little doubt that this growth will put added pressures on the forest recreation resource. Growth has been most noticeable between Kalispell and Hamilton, including the Flathead Valley, the Missoula area, and the Bitterroot Valley. The Gallatin Valley south of Bozeman has recently experienced a similar accelerating growth.

Visits are not recorded for much of the forest land, but on just three principal forest land ownerships nearly 9 million visitor-days (1 visitor day = 12 hours of use) were counted in 1971:

	Visitor-days
National Forests	6,863,000
Bureau of Land Management	474,000
Glacier National Park	1,339,000
Yellowstone National Park (2,252,000 total estimated, 10 % for Montana)	225,000
	8,901,000

National Forests received a large portion of recreation visits, which have been recorded for many years. Based on these records, Montana National Forests have received a sizable share of all recreation visits to National Forest lands:

	All National Forests (*Visitor-days*)	*Montana National Forests* (*Visitor-days*)	*Montana percentage of total* (*Percent*)
1967	149,647,000	5,565,000	3.7
1968	156,655,000	5,471,000	3.5
1969	162,838,000	6,037,000	3.7
1970	172,554,000	6,248,000	3.6
1971	150,562,000	6,863,000	4.5
1972	183,958,300	6,857,900	3.7
1973	188,174,600	6,980,700	3.7

The State has 13 percent of the Nation's acreage in Wildernesses and Primitive Areas, lands where development for any purpose (except trails and occasional primitive visitor facilities) has been explicitly excluded. The extent of recreation usage of the individual areas is shown in table 4 (USDA Forest Service 1972). These areas make up between 11 and 12 percent of all National Forest lands in Montana and receive about 5 percent of the recreation use. Of the State's total forested area of 22.8 million acres, 8 percent is

Table 4.--*Extent and use of Montana Wildernesses and Primitive Areas*

Name	Acreage	Visitor-days	
		1970	1973[1]
WILDERNESSES			
Anaconda-Pintlar	158,000	19,000	26,300
Bob Marshall	950,000	115,000	106,600
Cabinet Mountains	94,000	9,000	14,000
Gates of the Mountains	29,000	2,000	1,300
Scapegoat	240,000	[2]	16,400
Selway-Bitterroot	252,000[3]	56,000	63,700
PRIMITIVE AREAS			
Absaroka	64,000	15,000	15,700
Beartooth	230,000	45,000	68,400
Mission Mountains	73,000	5,000	18,900
Spanish Peaks[4]	50,000	17,000	15,800

[1] Montana National Forests closed in August due to high fire danger.
[2] Created in 1972.
[3] Montana only; also about 1 million acres in Idaho.
[4] Proposed for expansion to 63,000 acres if classified as Wilderness.

currently in Wildernesses or Primitive Areas, 7 percent is currently under study to determine suitability for addition to the Wilderness System, and about 4 percent is currently included in the Yellowstone and Glacier National Parks (map at back of book).

Overall use figures show that on National Forest lands within Montana more time is spent traveling, either for its own sake or incidental to some other activity, than in any other recreation-oriented pursuit:

Activities, 1973, Montana National Forests	*Percent of total time spent in recreation*
Mechanized travel	26
Camping	20
Hunting and fishing	20
Winter sports	5
Recreation residences	5
Picnicking	4
Hiking	3
Water sports	4
Other	13

Camping is the other major activity that is done both for its own sake and as a part of some broader recreational experience. Except for hunting, hiking, and horseback riding, much of the recreation is limited to rather small portions of the forest--streamside, campground, ski area, and so on. Time spent traveling plus days at developed sites accounts for 60 percent of the total visitor-days to forest land. Of all those who camped overnight in Federal and State facilities in 1971, 43 percent used a travel trailer, 29 percent a pickup-camper, and about 16 percent a tent (Kirkpatrick 1973). Campers were about evenly split between those who stayed for one or two nights and those who stayed longer (Kirkpatrick 1972).

The third major category of recreation activities in Montana, hunting and fishing, is commonly believed to include opportunities of the highest quality found anywhere. Just as sightseeing opportunities are frequently forest-oriented, so are the opportunities for a variety of popular types of fishing and hunting.

Montana offers 47 species of birds and 19 species of fish, legally classified as game. In addition, there are 12 species of big game, of which 10 are hunted. Several of these species--elk, bear, goat, and moose--are found almost exclusively in forested and high-mountain habitats, as are a good share of both whitetail and mule deer, and bighorn sheep.

Virtually all the harvest of several species of big game and nearly half of the entire State harvest of deer have been on forest land. Harvest has been fairly stable over the past decade, with some year-to-year fluctuations due to changes in regulations, weather conditions, etc., that affect laws and hunter participation. Recorded are 669,000 visitor-days of hunting on National Forests in 1970, a 45 percent increase over 1960, and a 183 percent increase over 1955.

Fish and Game Department data indicate a smaller increase in total number of hunters, but show an increasing proportion of the State's residents are going hunting:

Year	*Percent of residents buying big game licenses*
1950	15
1960	18
1970	22

Montana also ranks third among the States in the sale of nonresident hunting licenses and tenth in nonresident fishing licenses.

We can only estimate the dollar value of recreation and its importance to the State and local economies. One indication is dollars spent on licenses and permits. Out of the total of $4,680,000 spent on fishing and hunting licenses between May 1, 1971, and April 30, 1972, over $2 million can be attributed directly to big game, not counting deer (Montana Fish and Game Commission 1972). If an appropriate share of deer license receipts and of general license fees was added, it would be reasonable to assume at least 50 percent of the State's sportsman fees accrue from hunting on forest lands.

In addition to providing recreation and food for sportsmen, the wildlife resource also provides intangible benefits to those who simply observe. In the 13 southeastern States, for example, the nonconsumptive enjoyment of fish, animals, and birds was found to be more highly valued than were all fishing and hunting experiences combined, based on nearly 10,000 interviews (Horvath 1974).

A 1971 mail questionnaire sent to about 12,000 Montanans (about 50 percent responded) revealed that many Montana residents have a preference for undeveloped recreation areas (Kirkpatrick 1973):

Type of recreation area	*Respondents' preference (Percent)*
Roadless areas characterized by natural wild conditions	15
Largely undeveloped areas where activities such as camping, fishing, and picknicking are common	27
Developed parks and campgrounds	22
Intensively developed areas such as city parks	7
Natural areas with outstanding tourist attractions	16
Historic and cultural sites	13

These respondents also reported they spend over one-fifth of all their leisure time in outdoor recreation and would like to spend even more, most notably in fishing.

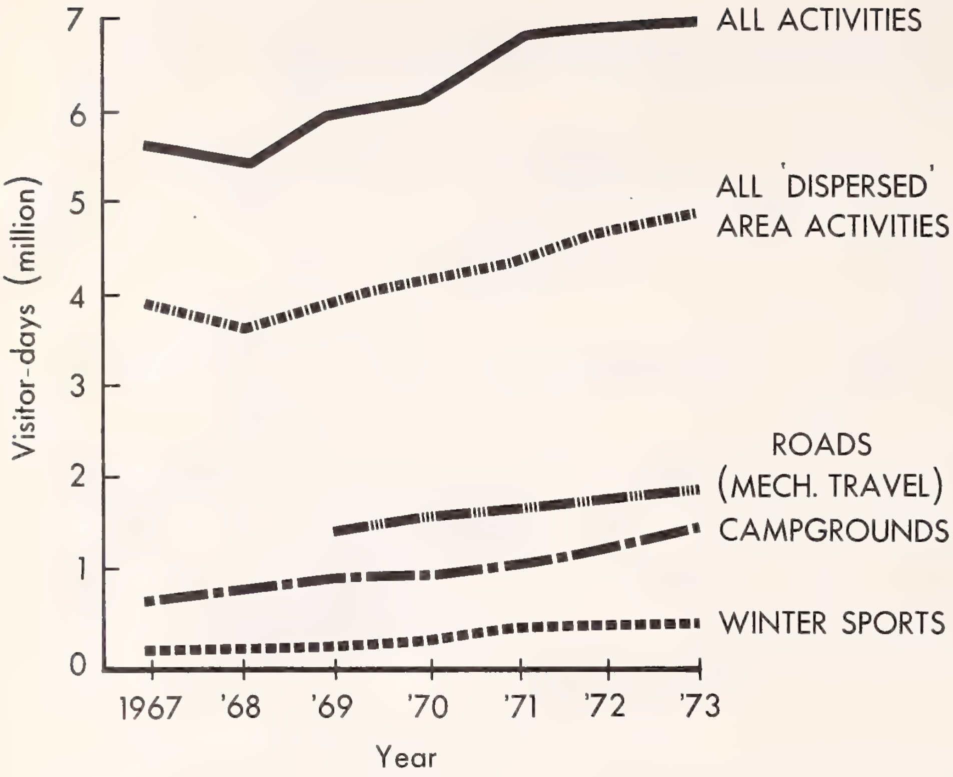

Figure 33.--Recreation visits to Montana National Forests, 1967-1971.

Although data limitations restrict our ability to trace changes over time, several activities have shown real growth in participation. Total recreation visits to National Forests, "dispersed" area uses, campground use, and winter sports visits--mostly skiing (State chairlift capacity has quadrupled in the last decade)--have all increased in recent years (fig. 33).

Highly developed, forest-oriented recreational subdivisions are also found in mountain areas and along rivers and lakes. In an area starting around Billings and extending west and north, there are several major mountain subdivisions. The best known of these is the $20 million Big Sky development in Gallatin County, which is expected to ultimately cover 10,000 acres. Included are a golf course, ski area, and 1,200 condominiums and residential home sites. In contrast, the densely developed $20 million Ptarmigan Resort area in Whitefish is expected to put a hotel, 500 condominium units, and 100 residential lots on a 457-acre tract. There are also numerous subdivisions that offer unimproved raw land, such as two 10,000- to 12,000-acre developments by Reforestation, Inc., located in Musselshell and Powell-Granite Counties (USDA State Committee for Rural Development 1973).

Grazing

In early days of the open range, much of the grassland resource was overgrazed. As the land was brought under management, grazing levels were reduced. Rehabilitation measures and improved grazing management have proved so effective that recently some increases in grazing have been permitted on forest lands. However, continued adjustments, both up and down, are likely to occur as range inventories are updated. On National Forest land, about 12 percent of the land suited for grazing is presently closed. On private and State forested grazing lands, about 1.4 million acres need forage improvement measures and about 0.7 million acres need reduction or elimination of grazing (USDA Soil Conservation Service 1970). In addition, much of the expansion of towns and development of ranchettes is on privately owned grazing lands.

Currently, there are about 2.8 million cattle and about 1 million sheep in Montana. Total required feeding for this livestock is about 36 million animal unit months (AUM) at 5 sheep = 1 cow = 1 animal unit.

Data from the Bureau of Land Management suggest that about 12 acres of woodland are needed for 1 AUM of grazing (620.3 thousand acres grazed, 51.7 thousand AUM's). On this basis, the 11.5 million acres of grazable woodland would provide about 1 million AUM's, or about 3 percent of total livestock feeding requirements. Based on estimated values of grazing, this represents about $20 million to the local economies. Although forest land grazing does not appear to provide a large portion of total grazing needs, it does provide a vital part of grazing in local areas, and values of grazing permits are often capitalized into values of farms and ranches.

Although it is sometimes necessary to keep livestock out of timber harvest areas until trees have regenerated, there may be up to 20 years of grazing available in recently harvested areas under some conditions (Basile and Jensen 1971).

Mining

In 1972, of a total of 250,000 mining claims on the National Forests in Montana, there were about 20,000 active claims, which often have a major local impact on forest cover and other forest values. The claims are distributed approximately as follows:

National Forest	*Number of active claims (1972)*
Kaniksu	4,000
Beaverhead	3,300
Lolo	3,200
Kootenai	2,700
Gallatin	1,900
Deerlodge	1,600
Helena	1,500
Custer	800
Lewis and Clark	400
Bitterroot	300
Flathead	50

Claims average about 20 acres each, for a total of 400,000 acres directly involved. Only recently have changes in mining laws given the Forest Service much authority over the disposition of timber on mining claims.

About 350 oil and gas leases have been taken on forested land. The leases involve a total of about 65,000 forested acres, most of it on the Custer National Forest in eastern Montana.

Recent interest in the vast coal reserves in eastern Montana has led to a debate over the legal and environmental aspects of proposed strip mining. In total, there are about 800,000 acres of coal-bearing land in the area, which constitutes about 13 percent of the Nation's coal reserves (Copeland and Packer 1972). However, only a small portion of this is considered currently available and suitable for mining, probably 120,000 acres over the next 50 years (Coordinating Committee, North Central Power Study 1971). These are primarily the low-lying areas along valley and stream bottoms, where the overburden that must be removed is shallowest. Presently, about 300 to 500 acres per year are being mined.

About 10,000 acres of coal deposits are on National Forest land; about 1,000 acres are in forest cover, primarily ponderosa pine. Timber values are not high in these dry, scattered stands, but the trees may provide important wildlife habitat and recreational uses.

The National Forest lands, and also similar lands outside National Forests, are locally important for livestock grazing, wildlife habitat, and recreation. Sites now being stripped for coal are the low-lying bottoms and rolling grasslands that provide winter grazing. On private lands this is also where ranch headquarters are located.

Several key issues concern public land managers and private landowners in the areas proposed for coal development:

1. The coal seams are sometimes aquifers, which if disrupted may affect movement, rate of recharge, and quality of water, and may have an impact removed from the actual mining sites (Montana Coal Task Force 1973).

2. The areas involved have important grazing, wildlife, and esthetic values. The technical and economic feasibility of returning mined lands to a desirable condition must be taken into account. Until cover is reestablished, grazing is impossible and wildlife will be displaced.

3. Over some of the coal beds the deeper soil is high in sodium which can prevent reestablishment of vegetation unless covered with fertile topsoils.

4. Erosion and sedimentation may occur, including both water-related erosion and dust from mines and from railroads, if the coal is transported from the areas.

Climatic conditions in eastern Montana, particularly the limited precipitation, make revegetation of mined lands difficult (Montana Coal Task Force 1973). Successful rehabilitation may demand land shaping, seedbed preparation, seeding, fertilizing, soil additives, water and sediment control, soil surfacing, and shrub or tree planting. Protection against insects, rodents, livestock, and big game may be required. Direct rehabilitation costs ranged from $700 to $1,800 per acre in 1974. At most, this might add a few cents per ton to the price of coal (Packer 1974). Techniques of rehabilitation and the protection of environmental values, as well as the economic and social trade-offs involved, are all under active study.

CHAPTER V

ENVIRONMENTAL ASPECTS OF FOREST USE

For convenience of presentation, the uses of individual forest resources have been discussed separately. In fact, though, rarely can one resource be utilized without generating direct and subtle impacts upon other elements of the forest ecological community.

In this chapter we discuss the principal environmental concerns surrounding two major forest uses in Montana, production of wood products and recreation, and two approaches being taken to minimize undesirable impacts. Much of this discussion is based on expert opinion simply because data do not exist on the relationships among forest uses and the forest environment.

Timber Harvesting and Road Construction

Commercial timber harvesting and the attendant road construction are the major man-caused disturbances of forest ecosystems.

The basic methods for harvesting timber are: (1) clearcutting, the removal of all trees in large blocks, patches, or strips; (2) seed-tree cutting, a clearcut with seed trees reserved as scattered individuals, groups, or strips; (3) shelterwood cutting, leaving a portion of the stand until seedlings are established; (4) group selection, many small clearcuts (1 to 5 acres) that are allowed to reproduce before further cutting in the residual stand; and (5) single stem selection, the harvesting of single trees.

Each harvesting method affects other values and uses of the forest. Shearer (1971) has compared the alternative cutting methods for one major timber type in western Montana, western larch, and has broadly judged the most desirable method relative to its effect on other forest uses as follows:

Consideration	*Most desirable type of harvest*
Esthetic attraction	Minimum disturbance
Livestock and big game forage production	
--quantity	Clearcutting
--use	Group selection to create small openings
Timber production	Clearcutting
Water production	
--quantity	Clearcutting
--quality	Minimum disturbance
Soil protection	Minimum disturbance

Notice in the above listing that, although clearcutting in western larch may produce the most big game forage, small open patches will be used most intensively. Clearcutting in small areas provides the most forest-edge habitats and favors some species. On the other hand, those species dependent upon unbroken forest cover may not prosper (Webb 1973).

Road systems that usually accompany logging may also severely and suddenly disrupt wildlife populations. Roading increases management opportunities when access is needed to distribute hunting pressure, but without adequate management controls roads can lead to a deterioration of hunting quality (Stankey and others 1973). Similarly, logging roads can destroy the habitat of some species and can, in conjunction with timber harvesting, create a variety of habitats favorable to other species. Whether to close roads or to keep roads open after timber harvesting is often a difficult choice for resource managers responsible for providing a variety of opportunities for hunters and other recreationists.

The forest lands of Montana offer a tremendous range of recreational opportunities, which have varying compatibility with timber production (School of Forestry, University of Montana 1972). Timber management can be modified to enhance recreational and esthetic resources. Timber stands in campgrounds and picnic areas can be selectively cut to remove individual trees that either are safety hazards or that prevent the desired pattern of facility development. Carefully planned cutting can open up scenic vistas along roads and trails; cuttings and subsequent regeneration can add variety to monotonous, even-aged, single-species stands.

With careful planning, large expanses of forest land can often include intensive timber management without impairing recreation values. In sensitive scenic and recreation areas, clearcutting may be undesirable. But elsewhere it may be a suitable method if small cuts are used and if cutting-unit boundaries blend with natural features. New logging techniques, including some that require fewer roads, are being introduced to minimize visual scars and ecological impacts of timber removal.

In still other situations, recreational and other noncommodity values are so high that timber harvesting should be precluded. Such is the case in Wildernesses, where Congress has said through law that the values of timber harvesting will be foregone.

Most frequently of all, timber production is modified to protect other resources. Such trade-offs are now the rule rather than the exception in Montana's forests. For example, harvest on National Forest lands has changed from virtually all clearcutting to currently over half partial cuttings, for both esthetic and environmental reasons.

Timber management cannot be described as categorically good or bad for recreation. Its impact depends on the extent and quality of study and planning given to each management decision and on sensitivity to various values in carrying out the program.

Road construction has often been a prime cause of soil movement and the subsequent silting of streams (Stone 1973). Physical characteristics of the land, engineering techniques used in construction, and the proximity to streams are all critical factors (Packer 1967). Currently, extensive reconnaissance inventories and mapping of fragile and unstable areas are underway to minimize undesirable consequences of roads. This work, based on studies of geology, vegetation, water, and soil, is aimed at determining just how much or how little disturbance forest lands can withstand (Layser 1974). One study indicates that a portion of the timber-producing areas on each of five National Forests should be deferred from use until thorough examinations can be completed (Wikstrom and Hutchison 1971).

On forest land where timber production is a primary management objective, highly productive soil may also be highly erosive. A sensitive approach emphasizes logging methods that disturb the ground surface very little, such as those using helicopters, overhead cable systems, or even horse logging. Full-tree logging to concentrate slash and reduce fire potential or using in-the-woods chippers to reduce air pollution also can minimize environmental disturbance.

In the construction of forest roads, ecologically sensitive management might dictate that the shortest distance between two points is not necessarily the best route. A road that conforms to the topography is generally preferred to a more direct road with huge cuts and fills. This might mean not only a road that rests more lightly on the land, but also one that is less costly to build. The same philosophy leads to fewer roads on a given area.

Some of these harvesting and road construction measures have already been adopted out of concern for the environment and can be found in any environmental impact statement concerning forest management. Case studies in Wyoming and Idaho found that current timber harvesting practices cost 24 and 10 percent more, respectively, than the practices followed 10 years ago (in constant dollars). The major reasons for these increases were intensified slash disposal, an increased reliance on artificial regeneration, and greater costs required to properly prepare and administer sales (Kemper 1974). In addition to higher costs for extracting timber, portions of the timberland base in Montana are only producing a fraction of the wood products that would have been produced a few years ago. These are the costs of providing a forest environment acceptable to the public.

Controlled fires are used extensively in timber management to reduce the occurrence of major conflagrations and to provide favorable growing conditions for commercially valuable tree species. While there is no convincing empirical evidence that the resulting smoke is harmful either to humans or to plants, it is a highly visible source of air pollution (Hall 1972). For example, lands administered by the Forest Service in the Missoula area have been cited as the source of substantial quantities of particular matter in the air (School of Forestry, University of Montana 1972).

Woody debris is broadcast burned or piled and burned on about 100,000 acres of forest land in the Northern Rocky Mountains each year (fig. 34). Forest managers strive to burn when winds and other atmospheric conditions

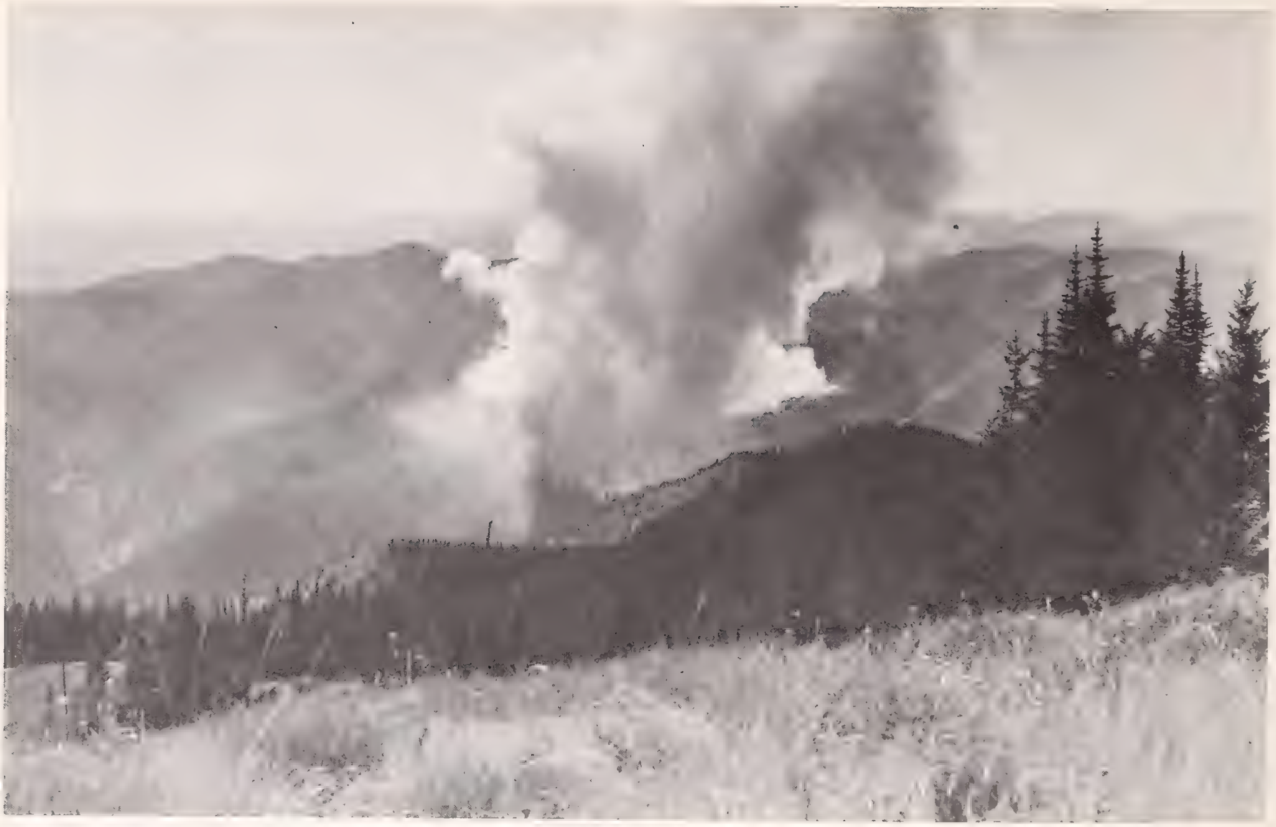

Figure 34.--Prescribed fire in the Northern Rockies. Forest managers strive to burn when atmospheric conditions will carry smoke away from populated areas.

provide maximum dispersions of the smoke. These fires have the following characteristics (Roe and others 1971):

1. Remote from urban-industrial problem areas;
2. at a relatively high elevation in mountainous terrain and well above inhabited valleys where air motion is most restricted;
3. large enough to produce strong convection columns that transport most smoke several thousand feet above the fires; and
4. of limited duration so the continuous hazes characteristic of low-elevation, urban, and industrial sources are avoided.

Given trends in increasing utilization of wood materials, available mechanical treatments and controlled burning techniques, it is possible to manage smoke so that the air quality where people live and spend their leisure time is protected.

Clearcutting and burning do increase overland water flows and soil erosion and cause very small losses of plant nutrients. Studies in western Montana, however, indicate that vegetative growth generally returns such areas to near prelogging conditions within a few years (DeByle and Packer 1972).

Wood Processing and the Environment[4]

In some areas, wood processing firms are located in valleys that act as inversion basins prone to air pollution during part of the year. Libby is a prime example; strong inversions are frequent and winds are very light. The nearly total stability of the valley air intensifies pollution from the combustion practices of the local lumber industry, from heavy traffic on dusty, unpaved streets, from open burning of trash, and seasonally from slash burning.

In the Missoula area, the Hoerner Waldorf Corp., the Intermountain Lumber Co., and the Evans Products Co. have each been cited as emitting 100 tons or more of particulate per year. Air sampling by the Missoula County Health Department in 1970 revealed that outside the county courthouse the suspended particulate level exceeded the maximum permissible annual mean concentrate. Less extensive measurements taken at other stations in 1971 suggested that particulate concentrations had been reduced and were below the Federal standard.

The first bill to regulate air pollution was introduced into the Montana legislature in 1963 and the Clean Air Act of Montana became law in 1968. In the next year, the Montana State Board of Health adopted basic regulations covering air pollution control and abatement activities and there have been a number of modifications since that time. Within a few years, most wood products firms were operating within these requirements.

A 1968 survey by the Montana Department of Health and Environmental Sciences revealed 88 tepee burners in operation statewide, none of which were capable of meeting State emission standards. By May 1970, 54 burners remained and were being examined for compliance. At the beginning of 1972, 48 burners were still operating, of which 8 were not always in compliance with regulations.

In 1971, 28 companies that responded to a statewide questionnaire reported a total of 29 tepee burners operating prior to 1968. Of these, 12 burners had been modified and 5 replaced by new burners; 7 had been eliminated by boiler systems, 4 by landfills and other uses, and 1 by mill closure.

The costs of meeting State requirements varied tremendously, from a low of $1,600 for modifying a small tepee burner to a high of $1.5 million for replacement of a boiler system. Installations are being further refined to comply with State or county regulations. (For a discussion of tax incentives as a means to encourage pollution control in the wood products industry, see Vaughan 1974).

Prior to construction of the pulp and paper plant in Missoula in 1957, a major share of Montana's residues from lumber and plywood mills was unused and disposed of by burning. With the pulp plant in operation and production increasing, utilization of residues, excluding bark, increased from 28 percent in 1962 to 74 percent in 1969. Approximately 63 percent of all mill residues, including bark, were used in 1969. With the recent construction of the fiberboard plant at Columbia Falls and the possible future construction of another particleboard plant at Bonner, residue utilization will probably increase further and the burning of residues should continue to decline.

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[4] In part, adapted from Western Wood Products Association (1972).

In the last several years, considerable research has been concentrated on the "blue haze" caused by the emissions of dryers in plywood, particleboard, and fiberboard plants. When such dryers are located near plants giving off wood smoke and sulfur, the dryer emissions can act as catalysts to create sulfuric acid in the atmosphere, one of the most hazardous of all air pollutants. Fortunately, current technology is adequate to control these emissions. The State's particleboard and fiberboard plants are said to have had the most advanced air pollution control measures incorporated into their construction.

Hoerner Waldorf's pulp and papermill has probably been the center of more angry comments than any other plant in Montana. These comments have centered both on the odors and the potentially hazardous emissions of the chemical processes (for example, see Carlson 1974). The firm has been engaged in an air pollution control program since 1970. Although it is not currently meeting emission standards and is operating on a variance, the firm has stated that it expects to overcome the problems in the near future.

Meeting State water quality standards has been less of a problem for the wood products industries than meeting air standards. Water quality tests as required for Federal discharge applications have been made and, where necessary, weekly measurements are taken.

Outflows from log storage ponds have generally been brought into compliance with legal requirements by constructing settling ponds and trash racks. Secondary treatment or chlorination of sewage disposal plant outflows has also been instituted. One operator filled his pond and went to dryland storage; in another instance, separate storm sewers were constructed. Most of the plywood plants and sawmills are recycling the waste waters used in their processes. The pulpmill has recently increased its holding pond capacity and has installed clarifiers; water discharges now meet State standards.

Impacts of Recreation on the Forest

Montana's forest-related recreation resources are outstanding in both extent and quality. Over the years, many components have been altered by use.

The chief cause of changes has been simply too many people treating the land too roughly. Even within legally protected Wildernesses, many main trails and campsite areas are characterized by badly deteriorated soil and vegetation. The cause of the problem is illustrated for the Mission Mountains Primitive Area in figure 35. Visitor counts show that use is concentrated in just the areas around three entry points. In the Bob Marshall Wilderness, a more widespread pattern of use still suggests that most people do not venture far from a few principal trails (fig. 36).

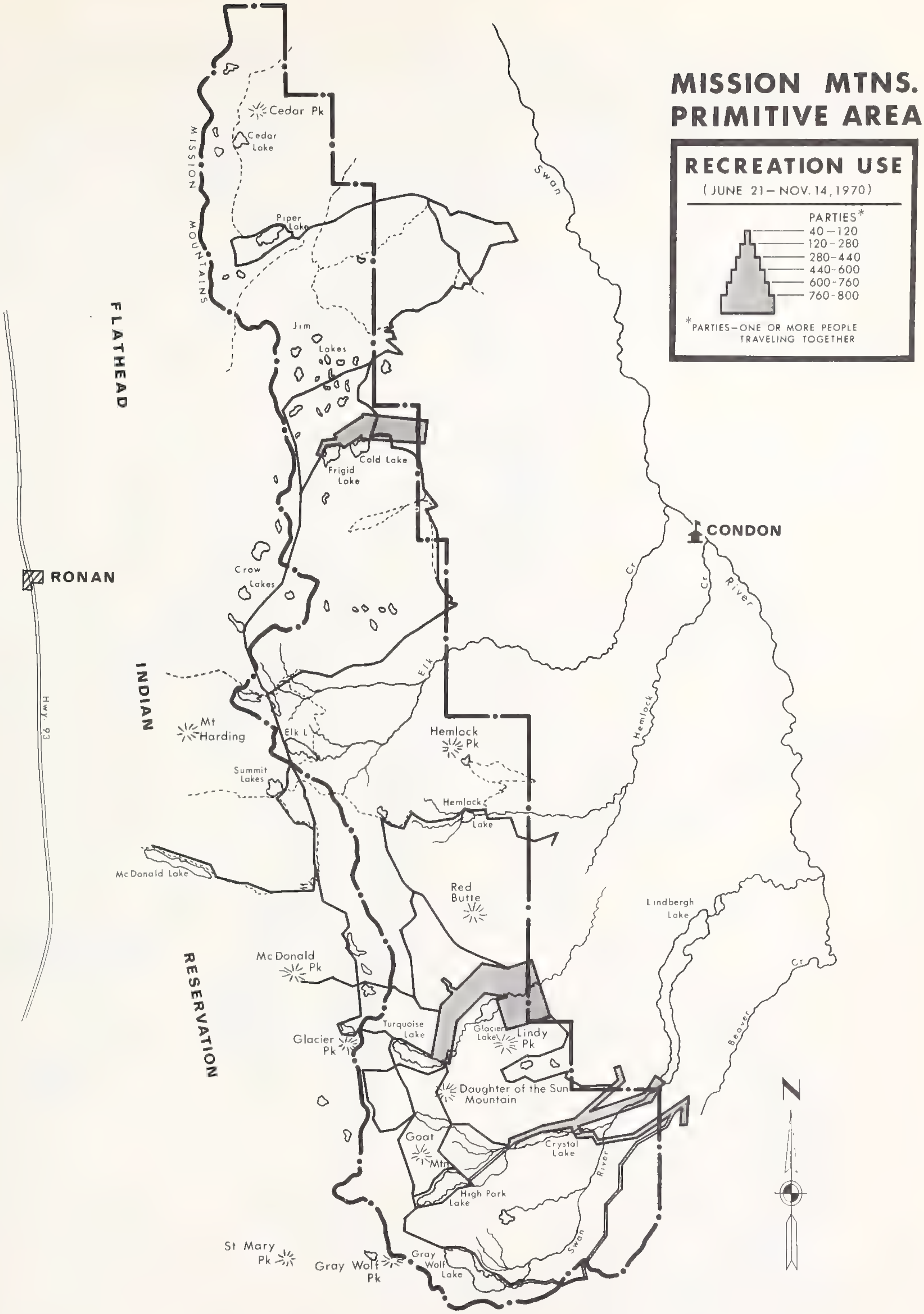

Figure 35.--Patterns of use in the Mission Mountains.

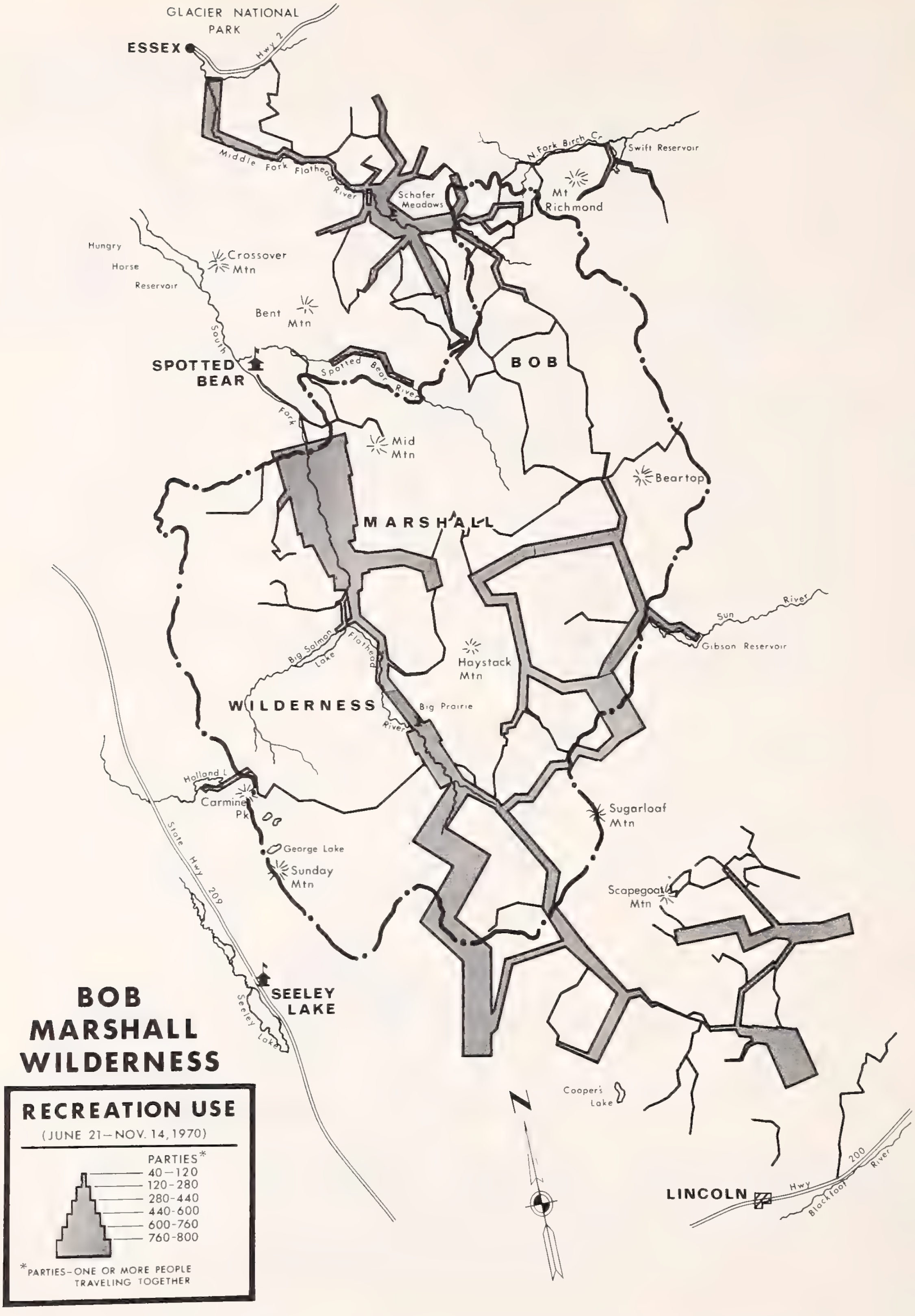

Figure 36.--Patterns of use in the Bob Marshall Wilderness.

It has been found that visitors use only a small proportion of the established trail systems in such areas. In the Spanish Peaks Primitive Area, for example, about two-thirds of all visitor travel occurs on one-fifth of the available trails (fig. 37). As one might anticipate, horse riders spread out more than do hikers. The use by all visitors is even more concentrated in both the Bob Marshall and the Selway-Bitterroot Wildernesses (Lucas 1974).

An important perspective on these use patterns is offered by the Wilderness Act of 1964, which defines solitude as a major quality of Wildernesses. But the quality of solitude, much as the physical resource itself, is fragile and easily degraded. Increasing congestion threatens the continued ability of visitors to find solitude. In addition, conflicts between different types of users--hikers and horsemen, large parties and small--are often serious problems (Stankey 1973).

To protect the intangible values of Wildernesses and to protect the physical resource itself, a redistribution of users seems necessary. Limits on numbers, methods of travel, and other activities appear inevitable in those areas where use pressures are increasing most rapidly (Hendee and Lucas 1973).

Another kind of use pressure that has changed the nature of the recreation resource is the demand for fishing in high-mountain lakes. Naturally low nutrient levels have led to fragile aquatic ecosystems producing few fish. Artificial stocking with brook trout, rainbow, and yellowstone cutthroat, even in Wildernesses has sometimes been to the disadvantage of native species.

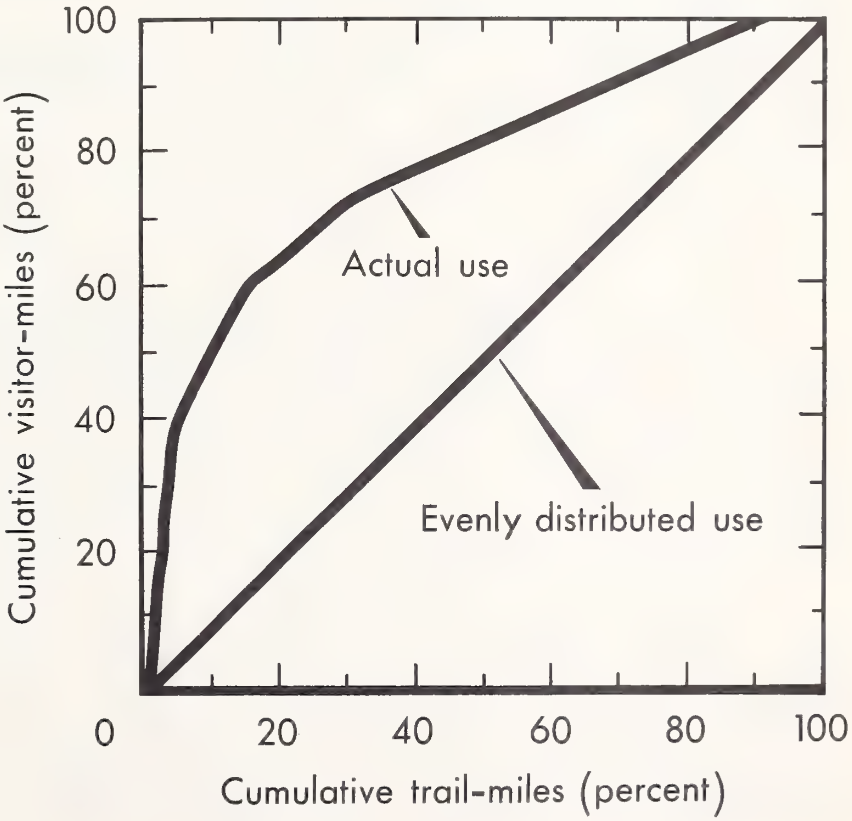

Figure 37.--Concentration of use in the Spanish Peaks Primitive Area, 1970.

Meeting the requirements of recreational visitors for overnight accommodations, sanitary services, solid waste disposal, parking space, etc., without degrading air, water, land, and biotic quality is a great challenge to public land managers and to private enterprises. The creation of very large, intensively developed recreation complexes clearly poses these problems (Nielsen and others 1973).

A more widespread problem of this nature is posed by the proliferation of subdivisions, frequently on the fringes of forested lands. For example, the Montana Fish and Game Commission judged that of 93 subdivision impact statements reviewed by the end of 1973, more than a third were directly detrimental to wildlife. From 1967 to 1972, approximately 9,000 acres of big game winter range was subdivided in Flathead County alone (Woodgerd 1974).

Another kind of problem exists in areas where black bears and grizzly bears are quick to take advantage of available food or garbage. Conflicts between humans and animals usually have been resolved in favor of humans. Restricting or removing animals has reduced the naturalness of the forest environment; to favor such animals would require restricting human use of that same environment. The best choice has not always been clear.

Forests have suffered from off-road use of recreation vehicles and from recreation-livestock grazing, especially in the vicinity of fishing lakes. Off-road traffic on unsuitable terrain and soils, notably in alpine areas, has necessitated closure of several areas to motorized vehicles. The problem is so severe that some National Forests recently announced rules to regulate off-road vehicles.

Snowmobile use has also increased tremendously in the last 5 years and in some locations is alleged to have adversely affected both vegetation and wildlife. In addition the noise of snowmobiles reduces the quality of the recreational experience for some users. One solution to these kinds of problems has been to set aside special areas and trails for snowmobiles.

Ecosystem Classification to Minimize Environmental Problems

To help forest managers better understand the environmental implications of their activities, widespread classifying and mapping of Montana's forest ecosystems are underway on public lands (USDA Forest Service 1973c). A related objective is to provide a basis for defining the potential productivity of the land for a range of products and services.

Ideally, the forest land itself, and the vegetative and water systems on that land would each be carefully studied, classified into homogeneous pieces, and mapped. In Montana, a method for classifying the vegetative systems of forest lands was completed in 1974; vegetative systems of the National Forests will be mapped by the end of the decade. Classification and mapping of the land system and, to a lesser extent, of the aquatic systems, are also underway.

Identifying and mapping the land system are necessary as a basis for predicting the results of management activities. For example, soil and slope interrelationships can be interpreted in the following terms:

1. Erodibility, land stability, compactibility, moisture handling characteristics, and soil temperature;

2. suitability for land treatment practices, such as establishing vegetation, or road and trail construction; and

3. subsurface moisture characteristics that may be important for road and dam construction or for drainage and sanitary facilities.

These interpretations are expressed as qualitative hazard ratings, based on the limited quantitative data that are available, and on the expert judgments of experienced soil scientists.

Classifying the vegetative system is useful in formulating a basic understanding of potentials and responses to vegetative manipulation. When combined with knowledge of land systems, the forest manager can estimate productive capacity, limitations and opportunities, and responses to a wide variety of land management alternatives.

Two systems are being developed for rating management implications of habitat types, the basic unit for vegetative classification in Montana (derived from Pfister and others[5]). One system centers on silvicultural considerations, such as the best cutting methods and regeneration techniques, as illustrated for several extensive habitat types in Montana in table 5. The other system develops potential productivity ratings for several different forest resources (table 6).

The same vegetative classification work has also provided at least a partial basis for understanding the role of wildfires in the forest and the susceptibility of various species to some forest insects and diseases.

By identifying critical physical characteristics of aquatic systems on forest lands, certain guides for forest management activities can be developed. For example, the importance when logging of leaving streamside trees to shade fish-producing areas will vary by type of aquatic system. Identification of the type of system permits the construction of specific management guidelines.

Productivity of the aquatic system frequently depends more on what is done to the land and vegetation than what is done to the aquatic system itself. Erosion of unstable soil, including streambanks, can be accelerated by road construction, logging, livestock grazing, wildlife use, etc., thereby reducing aquatic values.

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[5] Pfister, Robert D., and others. Forest habitat types of Montana. Intermountain Forest and Range Exp. Station, Ogden, Utah. (Manuscript in preparation.)

Table 5.--*Silvicultural implications of selected habitat types*

Habitat type Climax tree/undergrowth	Recommended silvicultural systems	Probability of natural regeneration success: Without scarification or prescribed burning	With scarification	With prescribed burning
Pinus ponderosa/ Festuca idahoensis (Ponderosa pine/Idaho fescue)	Selection	Low	Low to medium	Low
Pseudotsuga menziesii/ Physocarpus malvaceus (Douglas-fir/Ninebark)	Shelterwood Clearcutting	Low to medium	Medium	Medium
Abies lasiocarpa/ Clintonia uniflora (Subalpine fir/Queen cup beadlily)	Shelterwood Clearcutting	High	High	High
Abies lasiocarpa/ Zerophyllum tenax (Subalpine fir/Beargrass)	Selection Shelterwood Clearcutting	Low	Medium	Low to medium

Table 6.--*Relative productivity ratings for selected habitat types*

Climax tree/ undergrowth	Timber productivity	Wildlife winter use	Livestock forage production	Total water yield	Esthetic recovery after disturbance
Pinus ponderosa/ Festuca idahoensis (Ponderosa pine/Idaho fescue)	Low	High	High	Low	Low
Pseudotsuga menziesii/ Physocarpus malvaceus (Douglas-fir/Ninebark)	Medium to high	High	Low to medium	Low to medium	Medium to high
Abies lasiocarpa/ Clintonia uniflora (Subalpine fir/Queen Cup beadlily)	High to very high	Low to medium	Low	Medium to high	High
Abies lasiocarpa/ Zerophyllum tenax (Subalpine fir/ Beargrass)	Low to medium	Low	Low	Medium	Low to medium

Land Use Planning to Determine Forest Use

On the National Forests, which include nearly three-quarters of the forest lands in Montana, land and vegetative classification and mapping for land management planning are done by an interdisciplinary team. In Montana, planning units have been relatively small, but are being increased to 200,000 to 300,000 acres each. Planning proceeds simultaneously for all outputs, so that production of timber, wildlife, and recreation, for example, is coordinated from the start, and the development or preservation of all resources is done within the same planning horizon.

As a basis for the planning process, the following minimum steps are involved.

1. The local, regional, and national publics are informed of the process to be followed and are encouraged to participate.
2. Existing resources are defined, such as timber, forage, wildlife habitat, recreation sites, and trails and roads.
3. Basic data are gathered on geology, soils, hydrology, and land and vegetative classes.
4. Particularly sensitive areas that must be carefully handled are defined, including erosion and landslide hazards, unique features or resources that require protection and highly visible areas.
5. Given the existing conditions and constraints on development, the potential production of each resource is defined.

For nearly any land area, a variety of resource use combinations can be favored. Accordingly, the planning team defines a variety of options as alternatives for managing that forest area.

These alternatives are then presented for public consideration. The resulting public comments are assigned substantial weights in the choice of a management strategy. After a tentative decision has been made by the Forest Service, a draft environmental impact statement that documents the study procedure and the management alternatives is circulated for review and possible revision as required by the National Environmental Policy Act.

The above process is routinely used by the Forest Service, and some variation is common to other public agencies. In addition, private industry is giving increasing attention to environmental effects of their own activities. This is due to laws, as in the decline of tepee burners, and due to a recognition that public acceptance is important to success--as in the case of the voluntary issuance of an analysis of environmental and economic consequences of a proposed expansion of the State's only papermill (Hoerner Waldorf 1973).

A pilot study of land capabilities is underway by the Department of Natural Resources and Conservation. The study will develop a methodology which can be used by State and local planning staffs to assemble and interpret data concerning land and natural resources so that information can be utilized for land use planning. (USDA State Committee for Rural Development 1973).

CHAPTER VI

THE ECONOMIC SIGNIFICANCE OF FOREST RESOURCES TO MONTANA

All forest resources discussed in this report have economic value because their development or preservation has the potential to change economic activity. Because commercial timber has the greatest economic value by far, the focus here is on that resource. After describing timber-dependent employment and income in Montana, we discuss the implications of changing harvest levels and then provide a broader perspective on timber harvesting in Montana and in the Nation.

Employment and Income

Forest resources are one of the most important sources of economic strength in Montana. From the late 1950's to 1970, the numbers of employees in the commodity-producing industries have been shrinking, while those in the service industries have been increasing (Johnson 1972):

Sector	*Changes in annual employment from 1950 to 1970*
	(Percent)
Agriculture	-34
Mining	-35
Wood products	61
Other manufacturing	33
Total, commodity	-19
Total, services	33
All employment	14

In the commodity-producing group, the wood products industry has created the most new jobs (trends are shown in figure 38):

Sector	*Annual average employment*		
	1950	*1960*	*1970*
Agriculture	52,800	39,200	34,800
Mining	10,200	7,900	6,600
Wood products	5,400	7,400	8,700
Other manufacturing	12,600	13,200	15,200
Total, commodity	81,000	67,700	65,300
Total, services	147,500	169,200	195,700
All employment	228,500	236,900	261,000

In 1971, 11 counties in Montana had at least 100 employees in the wood products industries as shown in table 7. In aggregate, these counties accounted for about 93 percent of all wood products employment and earnings in the State in that year.

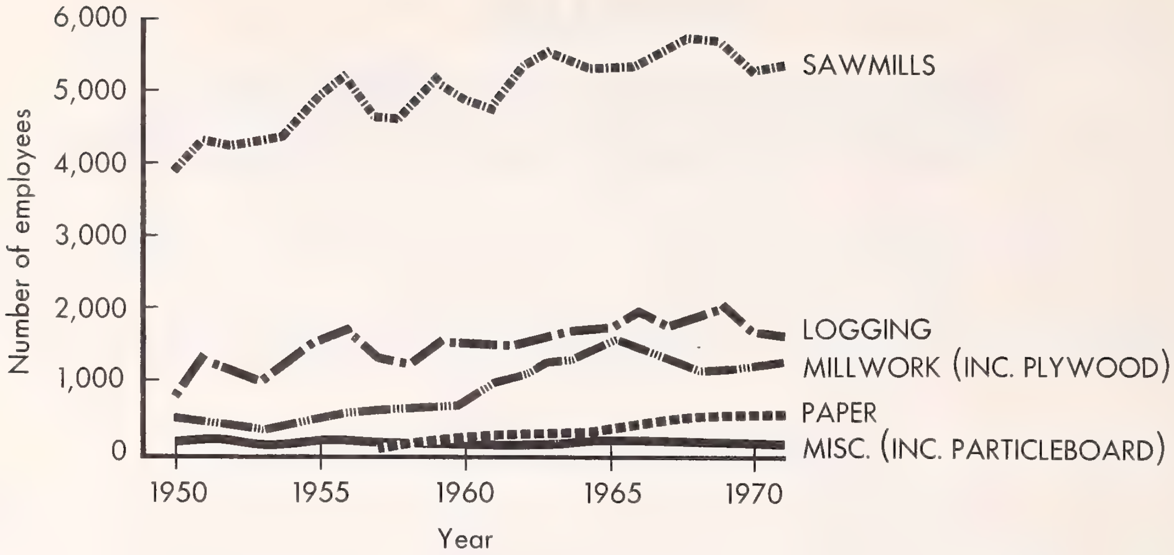

Figure 38.--Timber-dependent employment in Montana, 1950-1971.

In 1971, the average earnings of wood products employees in Montana (including those who worked just part of the year) were $8,260. This was a 31 percent increase over 1967 earnings, an increase slightly greater than for this industry nationwide.

Table 7.--*Montana counties with more than 100 employees in the wood products industries, 1971*

County	Number employees in wood products industries	Wood products employment as percent of total county employment	Average annual wages and salaries per employee in the wood products industries
		Percent	*Dollars*
Missoula	2,911	14	8,900
Flathead	1,849	15	8,100
Lincoln	1,575	27	9,100
Sanders	513	23	7,800
Gallatin	360	3	6,800
Ravalli	359	12	7,500
Lake	307	10	7,500
Mineral	264	27	8,100
Powell	187	9	7,600
Meagher	119	19	6,200
Granite	100	14	6,600

Table 8.--*Earnings of the Montana male workforce for selected industries, 1969*[1]

Sector	Proportion working 50-52 weeks	Median earnings of employees working 50-52 weeks	Earnings as proportion of U.S. earnings all employees
	Percent	*Dollars*	*Percent*
Forestry and fisheries[2]	64	9,634	126
Logging	48	8,582	170
Sawmills, millwork	69	7,716	123
Misc. wood products	57	6,976	118
Paper and allied products	79	9,820	115
Agriculture	77	5,211	115
Mining	74	8,357	95
Construction	56	8,429	99
Total Montana	73	7,669	91

[1] Tables 188 and 185, Census of Population, Characteristics of the Population: Montana, 1970. U.S. Department of Commerce, Washington, D.C.

[2] In this category 90 percent are Federal, forestry-related employees.

Overall, Montana males earned only 91 percent as much as their U.S. counterparts; in contrast, in agriculture and forestry-related industry they earned more than the average wage (table 8). The same kinds of relationships hold for female employees. For females working 50-52 weeks, earnings in sawmills and millwork were higher than in any other industry in Montana and much higher than the national average.

The total of these industry earnings made up 3 percent of all personal income in Montana and about 14 percent of personal income in western Montana, including Flathead, Granite, Lake, Lincoln, Mineral, Missoula, Ravalli, and Sanders Counties (Johnson 1972). If the sum of employment in agriculture, mining, manufacturing, railroads, and the Federal Government is accepted as an estimate of primary employment--the source of dollars to the State--and all other employment as derivative or dependent, the total direct and indirect personal income dependent upon the wood products industry can be calculated. Best estimates of these totals are about 11 percent statewide and more than 50 percent in western Montana, as shown in figure 39.

Federal civilian employment has been particularly important in Montana in recent years. Between 1950 and 1970, this employment increased 43 percent--nearly 12,000 employees or 4.5 percent of the total workforce--in the later year.

In fiscal year 1972 there were about 2,500 Forest Service employees in Montana, three-fifths of whom were permanent, full-time workers. About 1,000 worked in Missoula County at the Northern Region headquarters, the Lolo National Forest, and two laboratories of the Intermountain Forest and Range Experiment Station. Another 800 were headquartered in Ravalli, Flathead, and Lincoln

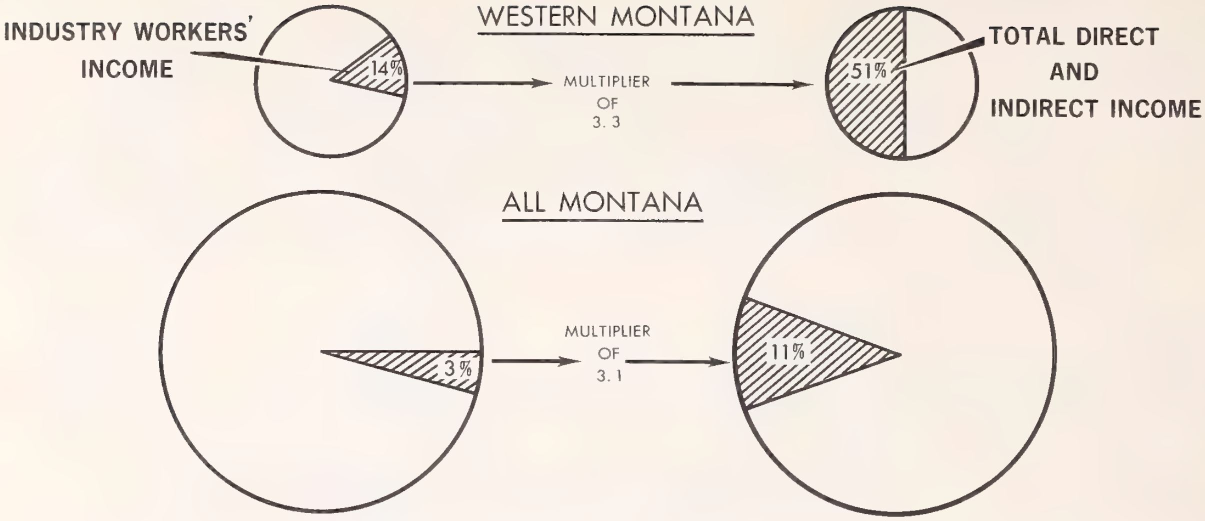

Figure 39.--Proportions of personal income attributable to the wood products industry in western and in all Montana, 1969.

Counties. These employees were involved in managing all of the forest resources, not just timber. The $28 million they received in wages and salaries was about one-third as much as the earnings of all employees in the wood products industry. When payments received by all forest-related employees of the State and other Federal agencies and by employees of the tourist industry are considered, counting only the wood products industry employment seriously underestimates the contributions of the forest resources to Montana's economy.

Workforce Characteristics[6]

Employment in the wood products industry is concentrated in those occupations which, on the average, are characterized by the least formal education. A quarter of all employees are classified as laborers, which is the largest proportion of any of the manufacturing industries.

The workforce of the wood products industry is relatively young, with only a small portion over age 45 (table 9). Sawmills and millwork plants, which include plywood production, and paper and allied products firms have comparatively young workforces.

The industry's dependence both on weather conditions and on seasonal employees is reflected in the proportion of employees who work year-round (see table 8). These proportions are about the same as for the United States as a whole. The seasonal nature of employment for wood products, for the construction industry, and for lodging (highly tourist-dependent), is pictured in figure 40.

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[6] Abstracted from a forthcoming publication by Intermountain Station entitled "A profile of forest industry employment in Montana" by Richard L. Porterfield.

Table 9.--*Age distribution for selected industries, 1970*[1]

Sector	Proportion of Workforce			Median age
	16-24 years	25-44 years	over 45 years	
	Percent			*Years*
Forestry and Fisheries[2]	24	48	28	35
Logging	12	54	35	39
Sawmills, millwork	16	48	36	38
Misc. wood products	23	32	44	43
Paper and allied products	10	67	22	35
Agriculture	15	34	51	45
Mining	14	44	41	41
Construction	11	48	41	41
Total for Montana	18	41	41	41

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[1] Source: Table 187, Census of Population, Characteristics of the Population: Montana, 1970. U.S. Department of Commerce, Washington, D.C.

[2] In this category 90 percent are Federal forestry-related employees.

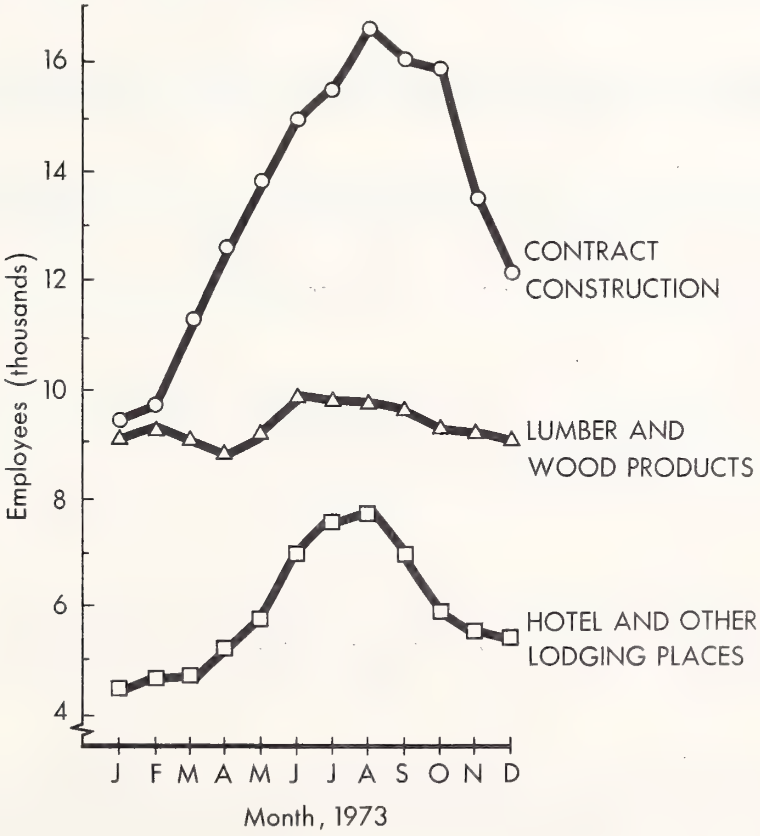

Figure 40.--Employment by month for selected industries.

Employment in the timber industry is hazardous. In 1972, 10 of 56 work-related fatalities in Montana occurred at logging or sawmilling operations, including 5 that were due either to falling trees or logs. The workmen's compensation program pays compensation and hospital, medical, and burial benefits for these and other injuries. Each industry is assessed a basic rate per $100 of payroll which depends on that industry's safety record in the preceding 5 years (a number of large organizations, such as Montana's pulpmill, have established comparable, self-insurer funds). Rates for fiscal year 1973 included:

	Rates per $100 of payroll (*Dollars*)
Logging and timbering (including contract log hauling)	25.00
Aircraft operation (including dusting, spraying, and stunt flying)	24.50
Underground coal mining	15.25
Sawmills	14.60
Road construction--rock excavation	13.90
Tie, post, and pole yards	8.60
Veneer manufacture	6.95
Planing mills	6.25
Policemen	5.05
Department stores--retail	.70

Logging and timbering has the highest rate of any industry or occupation in Montana.

Local Income From Out-of-State Recreationists[7]

The forest resources also contribute directly to Montana's economy by attracting recreationists who spend money within the State. The expenditures by out-of-State tourists, some portion of whom are attracted by the forests, are infusions to the State's economy. Although the data on such expenditures are fragmentary, we can crudely estimate their magnitude.

Our best estimate is that about 3.7 million tourists visited Montana in 1971, and they spent an average of somewhat less than $40 each during slightly more than 3 days (unpublished updating by Montana State Highway Commission of Wallace and Blake 1966). Allowing for increased prices, then, suggests that total out-of-State tourist expenditures now exceed $150 million per year.

Of this total, some portion is contributed by campers, hunters, and fishermen. In 1969, about 400,000 of the total number of tourists camped in established campgrounds. In 1973-1974, about 160,000 2-day and 34,000 longer term nonresident fishing licenses and 20,000 nonresident big game hunting licenses were sold. Recognizing that hunters and long-stay fishermen probably spend much more, and campers much less, than the average tourists suggests that the former kinds of recreationists are responsible for 10 to 15 percent of all out-of-State tourist expenditures.

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[7] Abstracted from a forthcoming publication by Intermountain Station entitled "A Montana perspective on tourist expenditures" by Paul E. Polzin and Dennis L. Schweitzer.

When tourist dollars are spent for goods and services, the sellers must in turn import much of their merchandise, so the major portion of tourist dollars quickly leaves the State. The following tabulation indicates the "direct" earnings of Montanans from the receipts of groups of firms at least partly dependent upon the tourist industry:

Sector	*Montana earnings per dollar spent*
Motels	$0.21
Hotels	.39
Cafes, restaurants, bars	.27
Food stores	.10
Gas stations	.11
Apparel and accessories	.17
Sporting goods	.15

After allowing for other payments by proprietors for utilities, manufactured-in-Montana goods, and for various services, probably $0.25 or $0.30 of the tourist dollar ends up in the pockets of Montanans. The total direct Montana earnings from out-of-State tourists, then, might be $40 to $50 million annually. Perhaps $5 million of this amount is attributable to campers, hunters, and fishermen.

Local Income From Commercial Forest Lands

In addition to providing employment in wood products and forest management to a substantial number of Montana citizens, the timberlands also provide direct income to the State, to individual counties, and to Indian Reservations:

Source of receipts	*Total 1972 receipts*	*Income to State, county, or tribe*	*Percentage of area of all Montana commercial forest lands*
	(Dollars)	*(Dollars)*	
National Forests	16,570,000	4,140,000	73
Bureau of Indian Affairs	4,200,000	3,900,000	3
Bureau of Land Management	240,000	10,000	2
Montana State Forests	890,000	890,000	2
Private timberlands (property taxes)	--	640,000	20

Income From Private Timberlands[8]

In 1970, there were 2.2 million acres of private timberlands listed on the roles of county assessors, primarily in the eight western counties. The major owners at present are:

Firm	*Acreage*	*Comment*
Burlington Northern Railroad	About 850,000	Acquired through merger of the Northern Pacific and Great Northern Railroads
U. S. Plywood	About 670,000	Purchased from Anaconda in 1972
St. Regis Paper Company	More than 200,000	

These three firms alone account for about three-quarters of the private timberlands listed by county assessors.

The revenues collected as property taxes from private timberlands are dependent upon the acreages listed by assessors and by the assessed values of those lands. In the mid-1960's, acreages of lands classified as timberlands increased and their average assessed values decreased due to implementation of State law requiring reclassification of certain marginal lands from agriculture to timber (fig. 41). Since then, average assessed values have remained nearly constant.

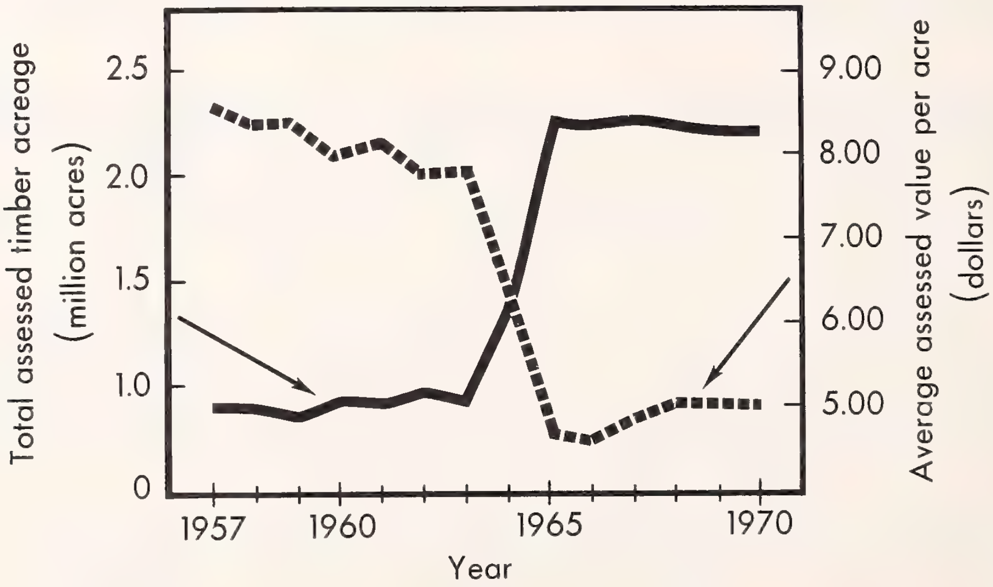

Figure 41.--Tax-assessed Montana timber acreages and average assessed values, 1957-1970.

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[8] From Burr 1973, and Smith 1973.

One might speculate that large timberland holdings, on the average, will tend to be among the most valuable timberlands. As support of such a hypothesis, in 1970 county assessors valued 670,000 acres belonging to Anaconda in western Montana at an average of $0.97 more per acre than the mean assessments for all timberlands in the respective counties.

Five of the most heavily timbered counties have asked for higher timber valuation schedules for 1974. The Board of Equalization estimates that the taxable values of timberlands in Montana will be increased by about 30 percent.

Income From Indian Reservations

Most of the monies received from timber sales administered by the Bureau of Indian Affairs were passed on to the tribal councils. These funds included 90 percent of total receipts plus certain matching funds for forest improvement work. The distribution to individual Reservations in 1973 was:

Reservation	*Receipts* (*Dollars*)
Blackfeet	40,000
Crow	67,000
Flathead	3,742,000
Northern Cheyenne	45,000
Rocky Boy	9,000

Income From the Forest Service

The National Forests are the major source of timberland-based funds for local units of government. By law, the counties receive 25 percent of net monies received by the Forests, apportioned on the basis of the average of the Forest lands within the counties. These receipts have generally been increasing since World War II, but wide year-to-year fluctuations have primarily followed changes in timber markets. The National Forests making the largest payments, that lay primarily or wholly within Montana, were the Kootenai, Lolo, Flathead, and Bitterroot, all in western Montana.

From all the Forests of the Northern Region, headquartered in Missoula, South Dakota received $3,000, Washington received $500,000, and Idaho received $2,900,000. Montana's share was divided as follows:

County	*Share of 1972 National Forests receipts* (*Dollars*)
Lincoln	1,400,000
Flathead	800,000
Sanders	500,000
Missoula	300,000
Mineral	300,000
Powell	200,000
Ravalli	200,000
Granite	100,000
20 other counties	less than 100,000 each
Total	4,100,000

Much smaller payments are also made by the Federal Government under Public Law 874. This law provides that school districts enrolling children whose parents work on federally-owned land may apply for funds to be used for maintenance, operation, and construction. As in the case of the 25 percent funds, such payments are intended to compensate for facilities that are not locally taxable. We estimate that in 1972, as a result of Forest Service employment, school districts received about $500,000 under this law, primarily in western Montana.

All of the forest-managing agencies also contract for services and equipment. In 1972, the Forest Service spent about $4 million in Montana in this fashion.

A final category of expenditures that has economic consequences for Montanans is capital investments in the land to assure continued production of timber and other products. Under the Knutson-Vandenburg Act, a portion of the receipts from timber sales is retained by the Forest Service to assure that new stands are satisfactorily regenerated and managed. In 1972, about $4 million was spent in the State for this purpose. For 1973, K-V funds amounted to 16.7 percent of all timber receipts in the Northern Region.

Because most timber stands are being harvested for the first time much of Montana's forests is unroaded. Consequently, the largest single capital investment is in road systems. Permanent roads are financed through reduced prices for timber stumpage to compensate timber purchasers for road construction and through appropriated funds. In fiscal year 1973, about $7.5 million of road construction was financed through stumpage sales (in addition to nearly $500,000 for temporary roads). Allowances for this road construction averaged about $18.50 per thousand board feet in western Montana and $16.70 per thousand board feet in eastern Montana. In addition, about $4.2 million of appropriated funds were used to construct roads, and another $4.6 million were used for engineering support of the development of purchaser-constructed roads.

Economic Implications of Changes in Timber Harvesting

Construction of new plants and the expansion of existing plants promise substantial increases in wood products production. Based on industry announcements, new primary employment in Montana over the next several years might include 200 jobs in lumber, 600 in plywood, particleboard and fiberboard, and 300 in pulp and paper production. If no jobs are lost elsewhere in the timber economy, this would represent an increase of more than 10 percent in direct timber-dependent employment.

Other projections generally agree that the wood products industry in Montana will grow. The relationships presented in figure 42 were derived from current official federal projections of economic activity (U.S. Water Resources Council 1972). Primarily because of an expected continuing decline in Montana's population over the next 30 years, total industrial earnings in the State are projected to increase much more slowly than for the Nation as a whole. But increases in the economic importance of the Montana wood products industries are expected to lead their U.S. counterparts and to become relatively more important to the State.

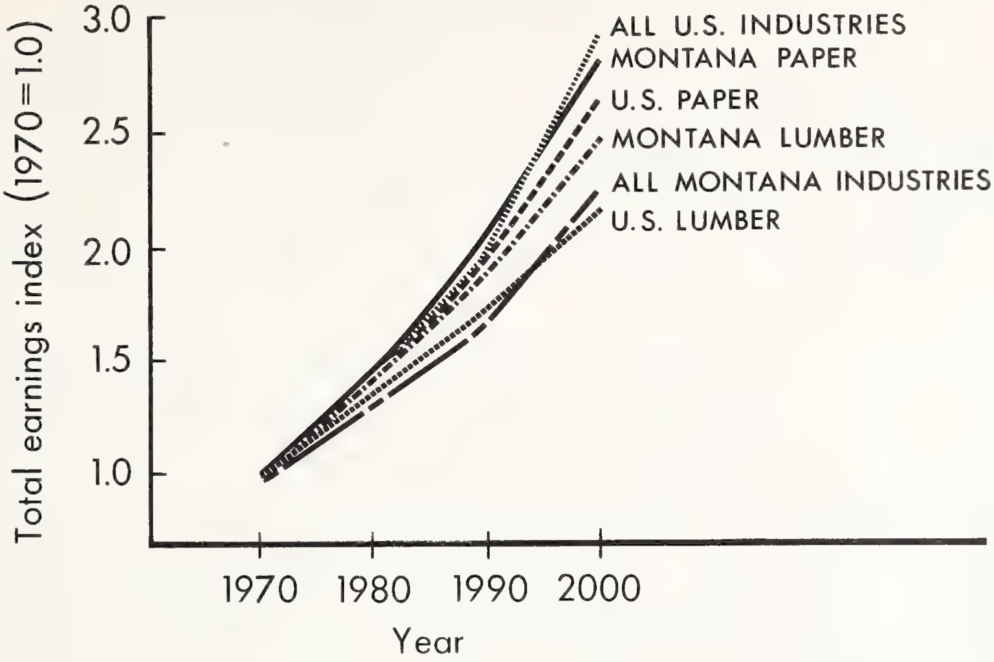

Figure 42.--Projected total earnings for selected Montana and U.S. industries, relative to total earnings in 1970. (Source: U.S. Water Resources Council. 1972. OBERS Projections: Regional economic activity in the U.S. (Series E Population), Vol. 4: States. 156 p., Washington, D.C.)

How realistic are such projections? No one knows for sure, simply because of the uncertainties encountered in looking ahead. These projections, for example, do not reflect current energy problems or recent trends in conservation and environmental concerns.

Many factors will determine the future level of wood products manufacturing. The factors are sometimes expressed through government action and sometimes through price changes in the marketplace:

1.--Federal laws or administrative fiats. The National Environmental Policy Act, for example, demands extensive public participation in agency decisionmaking and has a great potential for influencing the extent of both commodity and noncommodity production from the State's forest resources;

2.--State or local laws. State laws such as the Montana Environmental Policy Act can influence activities both in timber production and in wood processing;

3.--Social and economic forces. The proliferation of forest-oriented recreation and housing developments is constantly imposing new constraints on forest management activities:

4.--Changing prices. Prices for logs, lumber, and other wood products rise and fall as demand for new houses expands or contracts.

Any of these kinds of changes will bring a succession of repercussions. A new and restrictive interpretation of a law designed to protect wildlife, for example, might have an immediate impact on that forest resource, second-round impacts on the costs of forest management and the volumes of timber harvested, and third-round impacts on employment in the timber-processing industry. Insofar as we can predict these interactions, we can define the consequences to people.

We are not yet able to quantify social and cultural impacts except to the extent that they can be related to changes in personal income or employment. Similarly, a lack of empirical data severely restricts our ability to quantitatively evaluate environmental impacts. For example, we know that expanding timber harvesting into a new drainage will change the habitat for wildlife, increase the accessibility for vehicles, and lead to increased slash disposal and regeneration activities. There may be a net increase in production levels of local wood products plants, but we don't know yet whether there will be a net increase, decrease, or no change in environmental quality. This depends on developments in technology and processing and on a whole host of biological and social relationships that are not yet clearly defined.

A Case Study

For many years National Forests have been the principal contributors to Montana sawlog harvests. In 1972, these harvests amounted to about two-thirds of the State total. For this brief analysis we assume that Federal harvests will range from a 25 percent increase to a 20 percent decrease of that year's harvest as shown in table 10. For simplicity, harvests from all other lands are assumed to remain constant.[9]

Table 10.--*Hypothesized levels of timber harvesting in Montana*

Changes in harvest on National Forests (percent)	Volume change in harvest on National Forests	Actual harvest on National Forests	Harvest on other lands	Total Montana timber harvest	Changes in total Montana timber harvest
	Million board feet				*Percent*
25	188	938	450	1,388	16
10	75	825	450	1,275	6
0	0	750	450	1,200	0
-10	- 75	675	450	1,125	- 6
-20	-150	600	450	1,050	-13

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[9] Under a constant market demand, private harvests would undoubtedly increase, at least in part to protect the new capital investments in plants mentioned in Chapter III.

Table 11.--*Distribution of the average dollars spent by logging and wood processing firms*

Selling firms	Purchasing firms: Logging	Purchasing firms: Wood processing
	Cents	*Cents*
1. Logging	11	14
2. Wood processing	0	3
3. Other manufacturing	2	1
4. Transportation	10	17
5. Communications and public utilities	1	3
6. Construction	0	3
7. Agriculture and mining	0	1
8. Trade	4	5
9. Services	2	3
10. Households	50	32
11. State and local government	1	6
12. Federal government	10	2
13. Out-of-State	9	10

From an economic study at Montana State University, we know that logging and wood processing firms spent money throughout Montana's economy.[10] Reading down the columns of table 11, for example, we see that logging firms (those firms primarily engaged in logging, either independently or as contractees of wood processing firms) spent $0.10 of each purchasing dollar for services from transportation firms (line 4). Subcontracting and log transfers account for most of the $0.11 that logging firms on the average spend to purchase inputs from other logging firms. Labor, management, and owners, collectively called households, receive $0.50 out of the average dollar expenditure, but only $0.32 of each dollar spent by wood processing firms; logging firms are more labor-intensive. Payments to governments, principally for public stumpage and taxes, are shown in lines 11 and 12. Zero entries in the table reflect very small or no purchases.

When the numbers of dollars spent by logging and wood processing firms were matched to the assumed changes in timber harvesting (summarized in table 10), we found that a 10 percent change in harvesting on the National Forests would affect about 900 jobs statewide in the firms either directly or indirectly dependent upon timber (table 12).

Substantial magnitudes of economic impacts are associated with changes in harvest levels. Johnson (1972) estimated the impacts would be even larger than those shown above. For our lowest harvest level, the 20 percent Federal

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[10] Details of the economic input-output analysis used in this section are available from R. J. McConnen, Department of Economics and Agricultural Economics, Montana State University, Bozeman.

Table 12.--*Impacts of selected changes in timber harvesting levels*

Assumed changes		Impacts	
Change in harvest on National Forests	Change in total Montana harvest	Change in Montana personal income	Change in Montana employment
Percent	*Percent*	*Dollars*	*Man-years*
25	16	19,400,000	2,400
10	6	7,800,000	900
-10	- 6	- 7,800,000	- 900
-20	-13	-15,400,000	-1,900

and 12.5 percent statewide reductions, which are equivalent to a decrease of 150 million board feet, Johnson estimated a decline in personal income of $22 million and a decline in employment of 2,370 man-years; these estimates are 43 and 27 percent greater than ours, respectively. The net effect of the shortcomings that may exist in our analysis, then, would seem to be conservative.

Our rough estimates of impacts ignore the question of just where jobs and incomes might change. An increase in harvesting would lead to few new jobs in a town that has an unused capacity in supermarkets and other derivative industries. Lack of skilled labor locally may lead to the hiring of non-Montana residents to fill the higher paying new jobs, and local residents will not benefit, at least in the short run (Schaill and Power 1973; Smith and others 1971). The consequences of an increase in harvesting will generally not be the mirror image of the consequences of a decrease, except in a very crude sense. And, finally, we have not spoken at all about nonjob, nondollar consequences.

A Broad Economic Perspective on Timber Production

The human consequences within Montana of economic changes related to the timber harvest will depend as much on the availability of economic alternatives as on the magnitude of the changes themselves. The economic alternatives that may exist in other geographic locations and the general level of economic activity within Montana deserve consideration.

GENERAL ECONOMIC CONDITIONS

The relative attractiveness of alternatives in other geographic locations is the main factor that accounts for migration. Although fairly stable in total numbers, Montana's population has been made up of very mobile individuals. For example, between 1965 and 1970, more than one-third of the population made a major geographic relocation. Therefore, if jobs in an area decreased by, say 1,000, it did not necessarily follow that 1,000 people were without jobs in that area. Most of the people without jobs might have moved to another area. If economic conditions nationwide are bad and national unemployment is high, the local consequences of a reduction in timber harvesting will be different than if those economic conditions are good.

The general level of economic activity within the State is also important. In 1973, preliminary estimates suggest cash receipts to agriculture increased by as much as $200 million over the cash receipts for 1972. A decrease in timber harvest of 150 million board feet during a year in which cash receipts to agriculture increased by $200 million would hardly be noticed at the State level. There would, of course, be serious local impacts, but even they would be muted. On the other hand, if a decrease in timber harvesting coincides with a decrease in cash receipts to Montana agriculture, the combination of economic consequences would be severe.

The economic impact of changes in other, nontimber-related activities cannot be precisely determined at this time. But we do need to keep in mind that any adverse economic impact of a reduction in timber production might be offset by economic activity elsewhere. That is, the State's reduced ability to manufacture and export timber products might be compensated for by a simultaneous (but not necessarily related) increase in recreation or strip mining. Although forest-oriented recreation does not appear to be particularly promising as a source of new income and employment (Johnson 1968; Beardsley 1971), any increase could be of immense local value. More importantly, at the State level, new jobs related to increased strip mining for coal could far overshadow any foreseeable change in timber-based employment. Nevertheless, the timber industry is of substantial importance to the economic health of local communities and to all of Montana. But the state of the industry is beyond local control.

The wood products industry in Montana is primarily dependent upon an export market--we estimate more than 90 percent of Montana lumber is shipped out of State. All of the pulp and paper, and most of the plywood and particleboard, are also exported from the State. A larger proportion of roundwood products--posts, poles, houselogs--are used within the State but they make up a relatively minor part of the wood products industry.

DEPENDENCE ON NATIONAL MARKETS

Montana's wood product market is essentially the national market for softwood building materials. Some factors of interregional competition among different softwood-producing areas (such as species differences, transportation costs, availability of rail cars, local weather conditions) may from time to time affect Montana's sales of wood products; but by far the biggest influence on the market is general national economic conditions and particularly the activity in the construction industry.

If housing construction declines, the market for wood products shrinks, and the wood products industry in Montana suffers a severe economic blow. A national shortage of money for home mortgages leads to an economic contraction in Montana's wood products industry. Unemployment increases in the woods, in the wood products plants, and in the many businesses in Montana that are dependent on the wood products industry. Payrolls and tax receipts decrease. From Montana's point of view, any national failure of the construction industry is extremely painful.

The industry cannot be vigorous without a strong national demand for wood products. If that demand exists, the economic well-being of a substantial number of Montanans will depend on the supply of wood fiber to meet that demand.

MAINTAINING TIMBER SUPPLIES

In Montana, the available supply of wood can be increased as follows: (1) the harvesting of timber on land not reserved from harvesting can be increased; (2) through more intensive management, the production of timber per unit area can be increased; and (3) a higher proportion of timber grown can be converted into wood products.

The forests of Montana are primarily old-growth timber. Any increase in harvesting in the near future will require increased investment dollars to meet several basic management needs.

The first need is to insure that all other values of the forest are adequately protected and, hopefully, improved. On Federal lands such assurance is provided through the land use planning process, which fulfills the requirements of the National Environmental Policy Act (and there are parallel mechanisms applicable to other public and to private lands). This planning process, which includes the gathering of public comments and the preparation of Environmental Impact Statements, is expensive and time consuming. The same is true of all other aspects of planning, down to the actual timber sale layout, which in recent years has been done with a growing awareness of the effect any manipulation of one resource has on the other resources.

The second need is to provide physical access to timber that is harvestable. The rate at which adequate transportation systems are developed in previously unroaded areas, which is dependent both upon the rate of completion of the planning process and the availability of appropriated funds, sets an upper limit on how fast timber can be harvested. How much timber can be cut, especially on special and marginal areas, then will be at least partly dependent upon the logging systems that are available.

Finally, it is necessary to assure there will be a continuing supply of timber produced for future harvesting. The old growth was a gift of nature which, for the most part, has received little more than a custodial level of protection. But the responsibility has been accepted to assist nature in the future, to ensure the forests are not exploited without replacement. This implies both that newly cut areas and "back-log" acres must be adequately regenerated.

Earlier we discussed a variety of ways in which intensive management can increase timber production, starting with stocking control and including genetics. By concentrating only on the most productive half of the timberlands in Montana, we estimate that the State's average timber growth could be doubled. On the Federal lands, which provide the bulk of Montana's timber, such activities initially are not self-financing but are dependent on congressional funding.

The first requirement for utilizing presently unused wood fiber is that a market exists. The activities of the Montana wood products industry suggests markets are developing. Witness:

- --the 1974 opening of a fiberboard plant and the planning for a new particleboard plant,
- --the planned substantial expansion of the pulp- and papermill,
- --the steadily increasing purchases of Montana mill residues and dead roundwood by west coast pulp- and papermills,
- --the increasingly common utilization for lumber production of materials that a few years ago were too small.

In response to growing market opportunities for wood products, there has been an increasing effort to develop methods for better utilizing the wood resource, both in harvesting and processing. Improvements in sawmill technology during the past decade have permitted high-speed, economical sawmilling of small logs, and have reduced waste through narrower saw kerfs, and chipping headrigs convert slabs and edgings into pulp chips. Some of the newest small log mills can manufacture lumber from logs down to 2.5-inch diameter.

Skyline yarding of logs by systems of elevated cables is not yet widespread in Montana, but each year more and more harvesting is being done with this equipment. This permits logging in areas too steep or too fragile for ground skidding and has enhanced the opportunities to log in partially cut stands. Some work has also been done in field-chipping of forest residues to improve the recovery of available fiber.

In most mature stands in Montana 25 to 50 percent or more wood fiber--tops, branches, cull material--remains after logging. It may not be economically feasible to capture all this fiber in the immediate future, but current trends in utilization and research work now underway show promise for making much of this fiber technologically available. This is a direct and potentially low-cost source of new supply (Vaux 1973).

Insofar as the wood products industry is able to develop and maintain efficient national marketing channels and production processes that meet prevailing esthetic and ecological constraints, industrial demands for these fiber materials will undoubtedly grow.

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Headquarters for the Intermountain Forest and Range Experiment Station are in Ogden, Utah. Field Research Work Units are maintained in:

Boise, Idaho
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☆ U.S. GOVERNMENT PRINTING OFFICE: 1974 — 677-093 / 37 REGION NO. 8

SCHWEITZER, DENNIS L., ROBERT E. BENSON, AND RICHARD J. McCONNEN.
1975. A descriptive analysis of Montana's forest resources. USDA For. Serv. Resour. Bull. INT-11, 100 p. (Intermountain Forest and Range Experiment Station, Ogden, Utah 84401.)

One-fourth of Montana is forested. The forest's wildlife, recreational opportunities, forage, water, minerals, and timber are important to the economy and environmental quality of the State. Although some problems exist, progress has been made in reducing the conflicts among these uses and in reducing threats to air and water quality.

OXFORD: 644.5; 905.2.
KEYWORDS: Use (forest land); resources, forage, timber, minerals, water, recreation, wildlife, environmental quality, forest economics.

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MONTANA LAND OWNERSHIP

Federal public lands are keyed by colors to the administrating Agency. Lands in private or State ownership appear in white. Key public recreation areas also are shown.

This map was adapted from the "Natural Resource Lands in Montana" series published by the Bureau of Land Management, U.S. Department of the Interior. The cooperation of the BLM in providing basic materials to print this version is gratefully acknowledged.

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DOMINION OF CANADA
NORTH DAKOTA
SOUTH DAKOTA
WYOMING
IDAHO
BLACKFEET INDIAN RESERVATION
GLACIER
TOOLE
LIBERTY
HILL
BLAINE
FORT BELKNAP INDIAN RESERVATION
ROCKY BOY'S INDIAN RESERVATION
DANIELS
SHERIDAN
FORT PECK INDIAN RESERVATION
ROOSEVELT
RICHLAND
DAWSON
PONDERA
CHOUTEAU
GREAT FALLS
CASCADE
FLATHEAD INDIAN RESERVATION
GARFIELD
PETROLEUM
FERGUS
JUDITH BASIN
MEAGHER
WHEATLAND
GOLDEN VALLEY
MUSSELSHELL
BROADWATER
TREASURE
ROSEBUD
YELLOWSTONE
SWEET GRASS
STILLWATER
CARBON
BIG HORN
CROW INDIAN RESERVATION
NORTHERN CHEYENNE INDIAN RESERVATION
POWDER RIVER
CUSTER NATIONAL FOREST
PARK
GALLATIN
SILVER BOW
DEER LODGE
MADISON
LEGEND
Lands administered by the Bureau of Land Management – Public Domain
Cooperative Administered Lands, BLM-BSFW
BLM District Office
BLM State Office
BLM Administrative Boundary
Lands Administered by the Bureau of Sport Fisheries and Wildlife
Lands Administered by the Bureau of Indian Affairs
Lands Administered by the National Park Service
Lands Administered by the Forest Service
National Forest Regional Office
Montana State Fish and Game Dept. Central Office
Montana State Fish and Game Dept. District Office
Montana State Parks (with name)
Montana State Fishing or Boating Access Sites
Recreation Sites or Camp Sites
Highway Rest Areas
Ski Areas

Federal lands are open to the public, for hunting and other forms of outdoor recreation, but you may need permission to gain access when using private roads or crossing private property